invente 6.0

REALM OF VIRTUALITY

8th, 9th OCTOBER 2021

TECH VIBE

ssn

From the Principal's Desk

Sri Sivasubramaniya Nadar College of Engineering has a vision of transforming people's lives through Education. The Mission is to provide all round growth. Growth in a student is not only the academic growth but also the growth in societal skills. The four years in this campus is knitted with several activities that provide an immersive experience in Academics, Sports, Research and Extra curricular activities. This is a Second Home that provides youngsters an opportunity to explore their inherent skills to fly high, with the confidence that they can always land in safe grounds.

One such experience building exercise is the opportunity to conduct a massive "Skill showcasing event" called Invente. True to its name, it is an Inventive step that brings about the Innovative innate skills of students. Every aspect of Professional life is brushed up, showcased and assessed against the best of the rest. This event gives an opportunity to gain experience in meeting, greeting and learning from professionally groomed youngsters as well as experts.

While externally it appears like an event, internally, in the heart of hearts, it is a disciplined festival that sets many a soul in its life's trajectory. Those who conduct, learn enormous skill in Management. Those who participate learn a lot on how far they have to go to become a professional in their field of passion. People like us who simply sit and watch, enjoy the level of maturity, our children have achieved in organizing an event of such a scale. In all aspects, Invente is an unmatchable learning process. This year, it is an additional learning to learn to do all this online.

I welcome you all to the next phase of learning through the Celebration of Technology.

VE.Annamalai

From the President's Desk

Innovative technology has become an integral part of our daily life. One of the primary objectives of SSN is to promote 360-degree holistic development of students whereby we aim to nurture and develop graduates into socially conscious citizens of tomorrow. SSN today has completed 25 years of glorious existence. When we look back, our students have excelled in myriad facets such as academics, research, co-curricular activities, extracurricular activities, sports, leadership skills, entrepreneurship and social service among many others.

Invente, the annual symposium is an event organized solely by students of SSN to showcase exemplary co-curricular achievements and encourage knowledge transfer amongst student community throughout the country. Over the years, Invente has established itself as one of the premier tech fests, which students look forward to every year.

This year, the event is once again going virtual and promises to offer a unique platform for young minds to connect and interact with each other over co-curricular events. The symposium displays the combined efforts put forth by all the engineering departments of SSN. It further helps in the development of organizational and leadership skills, imbibing collective social consciousness amidst students.

I believe that this symposium would be an ideal opportunity to encourage and foster innovative skills apart from technical competence, bringing out the finest, especially, in this new normal. It will be a truly enriching experience for the students.

I wish the students, participants, organizers, and others involved with Invente 2021, all the very best for successful conduct of the symposium.

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Department
Of
Biomedical
Engineering

From the HOD's Desk

Department of Biomedical Engineering

Biomedical engineers have always been a bridge connecting technology and healthcare. And this year, with the pandemic paralyzing the entire world, we all have witnessed the extraordinary roles played by Biomedical Engineers in saving and supporting humankind. And we, the Department of Biomedical Engineering take this opportunity to add the flavor of healthcare to the National Level Technical Symposium INVENTE. Invente has been and will always be the pride of SSN, bringing together the faculty and student communities to work in harmony to give the best platform to explore and get exposed to different domains. It will give you a taste of the biomedical engineer's role along with alot of fun elements. You don't just test your technical skills but get a chance to portray your passion, teamwork, communication, and a lot more. Dive into the big ocean called Invente and start your journey to discover your true interests. Let INVENTE 6.0 bring out all the talent and be a forum for interaction and inspiration. My best wishes to all the organizers and participants.

Dr. A. Kavitha
Head of Department
Biomedical Engineering

Research Write Up

ORGAN-ON-A-CHIP (OOC) TECHNvOLOGY

Jeslin Libisha J,II ME Medical Electronics

The organ-chips are biomimetic system with multi-channel 3-D microfluidic cell culture chip that can mimic the environment of a physiological organ and mechanical forces that cells experience in the human body. OOC deals with the ability to regulate key parameters including concentration gradients, shear force, cell patterning, tissue-boundaries, and tissue–organ interactions. It provides a useful platform to conduct real-time preclinical tests of disease in living organs. OOC is an extension of labs-on-chips (LOCs) and cell biology, permitting organ – specific context and organs that have been simulated include brain, lung, heart, kidney, artery, skin, bone, cartilage, etc,. In addition to properties of biocompatibility, mechanical stability and processability under physiological conditions, specific constraints should be considered in OoC design such as Choice of scaffold materials, three dimensional (3D) microarchitecture, biomimetic structures and Functional tissue-tissue interfaces.

i. Choice of scaffold materials - The use of polydimethylsiloxane (PDMS) is advantageous in comparison to many other materials, owing to its transparency, flexibility and permeability to gas. The optical transparency of OoC micro-devices is a key advantage over animal models, because it enables direct real-time visualization and quantitative high resolution analysis of diverse biological processes in ways that have not been possible in animal models.

ii. Three dimensional (3D) microarchitecture defined by the spatial distribution of multiple tissue types. The geometry of each organ must be able to convey a certain number of cells, as defined by physiologically based pharmacokinetic/pharmacodynamic (PBPK/PD) rules. Specific ranges of shear stress to cells must be considered, depending on the type of cells cocultured for each organ tissue.

iii. Biomimetic structures constituted to mimic complex organ specific mechanical and biochemical microenvironments.

iv. Functional tissue-tissue interfaces.

OOC design concept:

Culture systems require the control of external and internal cell environments. OOAC combined with micromachining and cell biology can control external parameters and accurately simulate physiological environments. Dynamic mechanical stress, fluid shear and concentration gradients are required on the chip. Cell patterning should also be realized to fully reflect physiological processes.

(i) Fluid shear force

(ii) Concentration gradient

(iii) Dynamic mechanical stress

(iv) Cell patterning

Lung – on – a – chip:

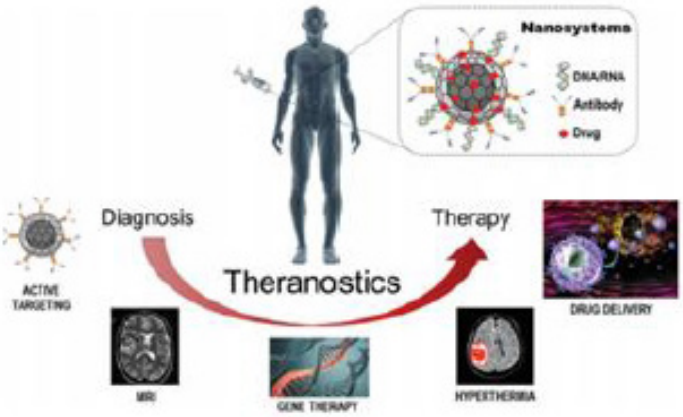
The first chip in this field is human lung alveolus-on-a-chip, which reconstitutes the mechanically active alveolar–capillary barrier in the human lung, developed by Donald E. Ingber. It contains two microfluidic channels, each culturing human alveolar epithelial cells or pulmonary micro vascular endothelium, to mimic the complicated physiological functions of the normal lung and the growth of orthotopic lung cancer.

Gas exchange in the lungs is regulated by the alveoli which can be challenging to reproduce in vitro. Microfluidics can establish extracorporeal lung models and lung pathologies through accurate fluid flow, and sustained gaseous exchange. Several design are carried out using i) soft lithography to divide the chip into regions separated by 10 μm PDMS membranes with an extracellular matrix (ECM). The upper PDMS regions had alveolar epithelial cells, whilst the lower regions contained human pulmonary micro vascular endothelial cells, thus mimicking the alveolar–capillary barrier. The structures of the membranes were altered under a vacuum to simulate expansion/contraction of the alveoli during respiration. Inflammatory stimuli were introduced into the system through neutrophils that were passed to the fluid channels. This produced a pathological model of pulmonary edema through the introduction of interleukin-2 (IL-2).

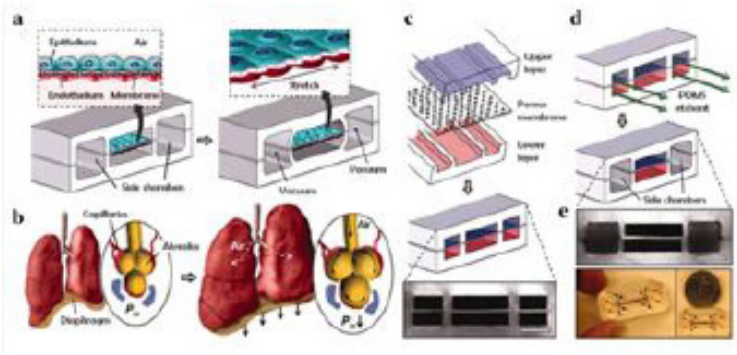
Lung tissue organ chips are useful as implantable respiratory assistance devices. In 2018, a lung assists devices (LAD) was designed to permit additional gas exchange in the placenta for preterm infants during respiratory failure.

Liver – on – a – chip:

The hepatic system is the major site of drug/toxin metabolism. The liver constitutes a series of complex hepatic lobules that confer multicellular functional communication. Maintaining the physiology of hepatocytes over an extended time period is challenging. The first liver based system consisted of microfluidic pores in which 3T3-J2 fibroblasts and rat liver cells were co-cultured to mimic an airway interface. Rat hepatocytes cultured in the chip could continuously and stably synthesize albumin and undergo metabolism. Several design are carried out using i) interstitial structure of endothelial cells and cultured primary hepatocytes, ii) radial electric field gradients that were produced using electrophoresis to pattern cells onto circular polydimethylsiloxane (PDMS) chips and iii)using a

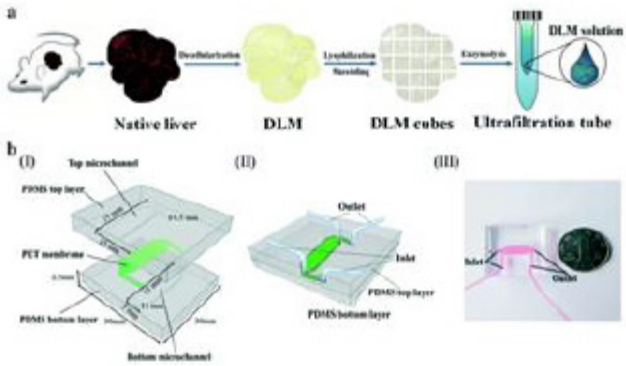


porous polyethylene terephthalate(PET) membrane and continuously perfused collagen and fibronectin-sanded rat primary hepatocytes. To improve the physiological models, 3D hepatocyte culture techniques have been used form microfluidic chips. In 2018, a system for biomimetic liver tumors through integrating decellularized liver matrixes (DLM) with gelatin methacryloyl (GelMA) to mirror the 3D tumor microenvironment (TME) was designed.



Intestine-on-a-chip:

Oral drugs have to transverse the small intestine to enter the bloodstream. Villi are key to absorption and their morphology must be maintained on the chip. The chips are developed to simulate the intestinal system, consisting of a glass slide permeable membrane and PDMS sheet containing the channels. Caco-2 cells were cultured on the chips. The micro-environment of the intestine was reconstructed through shear force and cyclic strains. Caco-2 cells show prolonged growth and maintained the microbial flora in the human intestine. The device permitted the exploration of the etiology of intestinal disease and identified therapeutic targets and drugs.

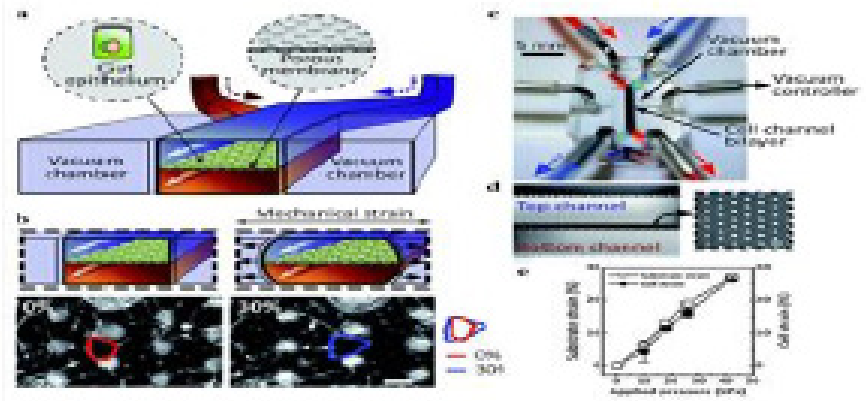


SONOTHERMOGENETICS - A NEW BRAIN SIMULATION TOOL THAT COMBINES ULTRASOUND AND GENETICS

Nithyashree B, III year BME

Imagine being able to non-invasively and precisely control your brain by turning on and off your neural activity, you could treat brain disorders that affect billions of people around the world like Parkinson's disease, epilepsy and depression. *Sonothermogenetics* is a new technique that might someday just deliver that. A multidisciplinary team at Washington University in St. Louis has developed this new brain stimulation technique using focused ultrasound that is capable of turning specific types of neurons in the brain on and off and precisely control motor activity without surgical device implantation. The team, led by Hong Chen, assistant professor of biomedical engineering in the McKelvey School of Engineering and of radiation oncology at the School of Medicine, is the first to provide direct evidence showing non-invasive, cell-type-

specific activation of neurons in the brain of mammal by combining ultrasound-induced heating effect and genetics, which they have named sonothermogenetics. It is also the first work to show that the ultrasound- genetics combination can robustly control behaviour by stimulating a specific target deep in the brain. Sonothermogenetics provides new tool for non-invasive cell type specific neuromodulation in the whole brain.

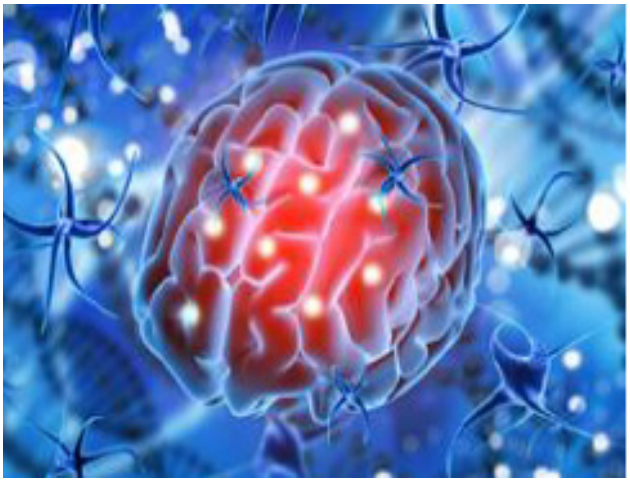


They developed a viral construct that can deliver these thermosensitive ion channels into selected neurons. These genetically selected neurons express the ion channels on the cell membrane. A few seconds of ultrasound sonification safely warms up the neuron and opens the expressed thermosensitive ion channels. These ion channels function as ultrasound controllable switches that can turn on selected neurons with densely wired brain circuits.

The team started using wild-type mice, and used adeno-associated viruses (AAVs) to express transient receptor potential vanilloid (TRPV1) specifically in CaMKII- expressing neurons in the stratum of the brain. TRPV1 is a member of the thermosensitive transient receptor potential channel (ThermoTRP) family, and is exquisitely sensitive to temperature, and controls intracellular Ca2+ influx.

Using a miniaturised wearable device on the head, a small burst of heat via low-intensity focused ultrasound was delivered to the brain, which resulted in a localised small temperature increase. This activated the TRPV1 ion channel in the genetically altered neurons, switching them on. The team was

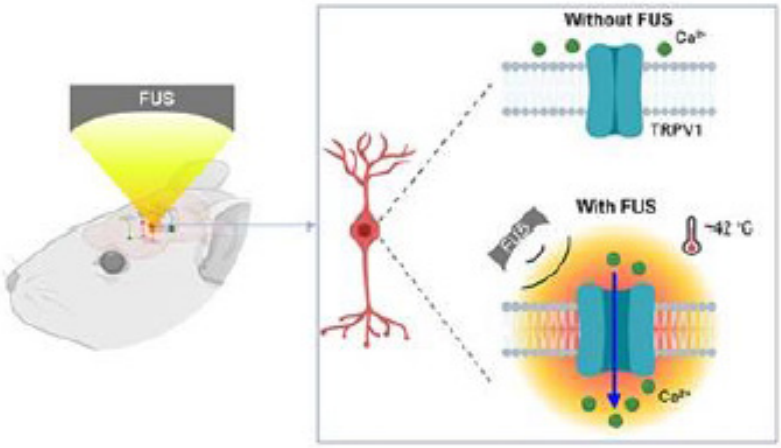
able to precisely and temporarily modulate the neural activity using sonothermogenetics by altering the ultrasound properties for example altering wave types (pulse or continuous), duration and time intervals between sequential stimulation. TRPV1+ neurons switched from a silent to active state only in response to FUS simulation meanwhile, nearby neurons without TRPV1 overexpression were not affected. The team also witnessed a change in behaviour of freely moving mice upon sonothermogenetics. FUS simulation repeatedly evoked rational behaviour in TRPV1+ mice which was not seen upon FUS stimulation of untreated (TRPV1-) control mice.



"Our work provided evidence that sonothermogenetics evokes behavioural responses in freely moving mice while targeting a deep brain site," Chen said.

"Sonothermogenetics has the potential to transform our approaches for neuroscience research and uncover new methods to understand and treat human brain disorders."

The team successfully showed for the first time sonothermogenetics can robustly control behaviour by stimulating a specific target deep in the brain. The new technology has the potential to transform approaches for neuroscience research, delivering a new method to understand and treat human brain disorders and it has the promise to target any location in the brain with millimetre-scale resolution without causing any damage. It offers the potential of scalability, to large animals hopefully humans in the future



TRANSDERMAL PATCHES

Raghupathy J & R Dhanush Babu
III Year BME

WHAT IS A TRANSDERMAL PATCH?

A transdermal patch is a medicated adhesive patch that is placed on the skin to deliver a specific dose of medication through the skin and into the bloodstream. Often, this promotes healing to an injured area of the body. An advantage of a transdermal drug delivery route over other types of medication delivery such as oral, topical, intravenous, intramuscular, etc. is that the patch provides a controlled release of the medication into the patient, usually through either a porous membrane covering a reservoir of medication or through body heat melting thin layers of medication embedded in the adhesive. The main disadvantage to transdermal delivery systems stems from the fact that the skin is a very effective barrier; as a result, only medications whose molecules are small enough to penetrate the skin can be delivered by this method. A wide variety of pharmaceuticals are now available in transdermal patch form. A transdermal patch which delivers medication is applied to the skin in a medical setting. The patch is labelled with the time and date of administration as well as the administrator's initials.

TRANSDERMAL DRUG DELIVERY SYSTEM (TDDS)

Transdermal drug delivery system (TDDS) has been an increased interest in the drug administration via the skin for both local therapeutic effects on diseased skin (topical delivery) as well as for systemic delivery of drugs. The skin as a site of drug delivery has a number of significant advantages over many other routes of drug administration, including the ability to avoid problems of gastric irritation, pH and emptying rate effects, avoid hepatic first-pass metabolism thereby increasing the bioavailability of drug, reduce the risk of systemic side effects by minimizing plasma concentrations compared to oral therapy, provide a sustained release of drug at the site of application; rapid termination of therapy by removal of the device or formulation, the reduction of fluctuations in plasma levels of drugs, and avoid pain associated with injections. The transdermal delivery can also eliminate pulsed entry into the systemic circulation, which might often cause undesirable side effects.

Diabetes mellitus is a major and growing health problem worldwide and an important cause of prolonged ill health and early death. It is a chronic metabolic disorder characterized by a high blood glucose concentration (hyperglycemia) caused by insulin deficiency, and it is often combined with insulin resistance. Repaglinide is an oral blood-glucose-lowering drug of the meglitinide class used to treat NIDDM (noninsulin-dependent diabetes mellitus). It lowers blood glucose by stimulating the release of insulin from the pancreas. It has an extremely short half-life of 1 h. In addition, the oral bioavailability of Repaglinide is low (56%) due to extensive hepatic first-pass effect. Dosage frequency of Repaglinide is 0.5 to 4 mg in 3 to 4 times in a day. It has a melting point of 130-131°C and mol. wt. 452.58. It belongs to class 2 drugs. Repaglinide topical preparation may be beneficial to the patient since it reduces adverse effects and avoids hepatic first-pass metabolism. The need for transdermal delivery of Repaglinide is further justified due to the requirement of maintaining unfluctuating plasma concentrations for effective management of blood sugar for a long period in diabetic patients. The purpose of

the present work was to develop transdermal formulation of Repaglinide which increases the patient compliance and also sustain the release of drug to increase the bioavailability by using different grades of HPMC and PVP K30 as polymers.

MANUFACTURING OF TRANSDERMAL PATCHES

A continuous process for forming a transdermal patch which comprises the steps of: continuously feeding a strip of material comprising a layer of permeable membrane; continuously feeding into close proximity and in face-to-face relationship with the first strip a second strip is formed of impermeable backing material; passing the first and second strips together through a filling and sealing station in which the material containing an active substance is introduced between the strips and pouches are formed by first sealing devices which seal the strips together in a longitudinal direction of the strips and second sealing devices which seal the strips together in a transverse direction of the strips; the size of the pouches being adjusted by adjusting the number position and/or frequency of operation of the first sealing devices and/or by adjusting the number position and/or frequency of operation of the second sealing devices.

NICOTINE PATCH

The nicotine patch releases nicotine in controlled doses to help with cessation of tobacco smoking. Nicotine patches are applied directly to the skin. They are applied once a day, usually at the same time each day. Nicotine patches come in various strengths and may be used for various lengths of time.

PROJECT/ INTERNSHIP WRITE UP

Winners Hackathon :

TEAM SYMBIOTS FROM SSN WIN 3RD TECHNOVATION HACKATHON SMART CITY ORGANIZED BY GREATER NOIDA INDUSTRIAL DEVELOPMENT AUTHORITY

BY: Anjana Anand, Lokesh Kumar M,
Rebecca Maria G, Sherwin Robert
IV Year BME

On the occasion of the 30th Foundation day of the Greater Noida Industrial Development Authority (GNIDA), Sharda University in collaboration with GNIDA organised a Virtual "3rd Technovation Hackathon Smart City" . More than 500+ teams consisting of 2000+ students came together at the 7-day ***hackathon*** *organised by School of Engineering and Technology, Sharda University, in association with GNIDA. The event which brought together students from across 50 different colleges and universities from different states of the country with an aim to ideate and create innovative solutions for some of the critical issues faced by the people of Greater Noida.*

The hackathon took place for 7 days, from 21st- 27th January, during which different aspects of the proposed solution was evaluated, such as novelty of the solution, hardware components used, accuracy of the built solution, basic implementation of the solution, pitching a business idea based on the solution and many other factors. Each day, participants were evaluated out of 50 points based on the agenda of the day, and the final round took place on 26th and 27th of January 2021.

Team "Symbiots" comprising of Anjana Anand, Lokesh Kumar M, Rebecca Maria G, and Sherwin Robert – 3rd year BME bagged the coveted first prize for their project titled "Vitality Pro" in the Smart Health Domain, under the mentorship of Dr V Mahesh, Associate Professor, SSN College of Engg. The team bagged a cash prize of INR 30,000.

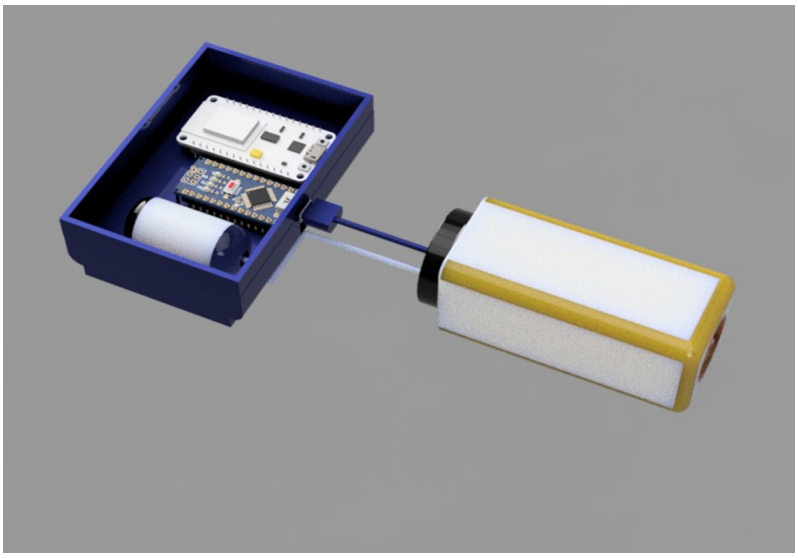
The idea behind the solution was to tackle a problem created by the pandemic – regular body vitals checkup. The use of noninvasive temperature sensors and pulse oximeters have become the norm in public areas and in a home setting to detect any symptoms of COVID-19. These devices exist separately, hence there is a need in the market to incorporate different body vitals acquisition in a single device. The idea behind the proposed solution was to design a **single module** that helps acquire four essential body vitals- **pulse, oxygen saturation, blood pressure, and temperature**. This is done **non-invasively**, at the **comfort of the patient's home**. The main idea is to promote regular health-care check-ups by exploiting the benefits of **IoT (Internet of Things) integration** with a mobile application.

The device can be used **standalone** to display the patient's vitals on an LCD screen available on the device; it can also be coupled with a mobile application that **offers online consultations** between the doctor and the patient. After the consultation, a prescription from the doctor is generated in the form of a QR code. The QR code can be scanned and accessed by the pharmacist to supply the required medicines. Therefore, the mobile application serves as a link between our three important clients: **patient, doctor, and pharmacist.**

The proposed hardware is simple to use and costs less than INR 5,000 to manufacture, making it a reliable and cost-effective solution during the pandemic era. The main problems the team aimed to tackle was firstly, cost-effective healthcare delivery for **urban and rural areas during the pandemic era**. **Instant and reliable vital measurement system** for elderly and people with comorbid conditions s the current need of the hour. Suh vitals acquisition devices can effectively reduce the need for **traveling to hospitals** during the COVID-19 pandemic. The team also wanted to encourage virtual consultations with the doctor with the facilities offered by telehealth, hence the solution developed can be used **individually** with an ease-of-use **mobile application.**

An appropriate business model for the VitalityPro device was also presented, which focuses on a commission-based model on online consultations.

The current proposed solution is being developed into a prototype and is in further discussion with organisations to develop it into a full-fledged medical device in the market.



Department Of Chemical Engineering

From the HOD's Desk

Department of Chemical Engineering

Message from the HOD:

As the convening department of Invente 6.0, I extend a warm welcome to all the participants and the resource persons who will be chairing the various sessions. The dogmas of Chemical Engineering lie in its versatility, and this year, my department students have prepared a plethora of exciting events imbibing these very ideals. Invente 6.0 provides a platform for the students for exchange of their ideas and information to keep abreast of the current developments. The overall objective of this mega event is to bring together the expertise and showcase the talents of the students in various disciplines. I encourage you, the budding engineers, to participate in this National Level Technical Symposium and foster your personal growth and career exploration.

With hopes that Invente 6.0 will promote positive interaction amidst the student community. I convey my best wishes for the event to be a grand success.

Prof. R.Parthiban. Ph D., MBA

Professor & Head

Department of Chemical Engineering

Technical Articles:

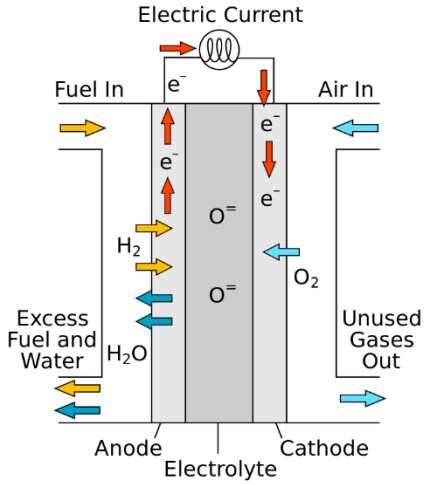
HYDROGEN FUEL CELL
A NON-POLLUTANT VEHICLE FUEL

WHAT IS FUEL CELL?

A fuel cell uses the chemical energy of hydrogen or other fuels to cleanly and efficiently produce electricity. If hydrogen is the fuel, the only products are electricity, water, and heat. Fuel cells are unique in terms of the variety of their potential applications; they can use a wide range of fuels and feedstocks and can provide power for systems as large as a utility power station and as small as a laptop computer.

WORKING PRINCIPAL OF FUEL CELL.

Fuel cells work like batteries, but they do not run down or need recharging. They produce electricity and heat if fuel is supplied. A fuel cell consists of two electrodes (a negative electrode, or anode and a positive electrode, or cathode) sandwiched around an electrolyte. A fuel, such as hydrogen, is fed to the anode, and air is fed to the cathode. In a hydrogen fuel cell, a catalyst at the anode separates hydrogen molecules into protons and electrons, which take different paths to the cathode. The electrons go through an external circuit, creating a flow of electricity. The protons migrate through the electrolyte to the cathode, where they unite with oxygen and the electrons to produce water and heat.



WHY HYDROGEN FUEL CELL?

There are several things about the hydrogen fuel cell that make it interesting. First, their potential for electric vehicles. Vehicles powered by the fuel cell can be refilled very quickly, especially when compared

to the time taken for a traditional battery to recharge. Second, the environmental impact of the fuel cell is greatly reduced – in fact, these cells have lower or even zero emissions compared to combustion engines. Hydrogen fuel cells emit only water, altogether resolving critical climate challenges as there are no carbon dioxide emissions. Fuel cells can convert the chemical energy in the fuel directly to electrical energy with efficiencies capable of exceeding 60%. There also are no air pollutants that cause health problems by means of smog etc., at the point of operation. Additionally, fuel cells are quiet during operation as they have few moving parts.

Fuel cells can also be used in a wide range of applications, providing power across multiple sectors, including transportation, industrial/commercial/residential buildings, and long-term energy storage for the grid in reversible systems.

ADVANTAGES OF HYDROGEN FUEL CELLS:

Advantage over electric vehicles: As mentioned previously, the main disadvantage of the electric fuel is that the time required for the recharging of batteries, while hydrogen fuel can be refilled faster and easier like other combustible fuels.

Advantage over combustion engine vehicles: The main disadvantage of combustion engine vehicles comes from the fact that they cause pollution. Hydrogen fuel cells, on the other hand, do not have this problem.

DISADVANTAGES:

Hydrogen exists as a gas at room temperature and atmosphere pressure. This means that huge container are required for the storage of the fuel. While compression is an option, it increases the cost and indirectly curtails some possible applications of fuel cells.

R. Ajin Kumar IIIrd year ChE

Nanopesticides: A promising new pesticide solution?

Every year in India pests and diseases eat away on an average 15- 25% of food produce. To offset the growing demand for food grains, either the area under the production should be increased or productivity of the existing land should be improved. As the arable land is limited, increasing productivity is the only realistic option available.

In order to achieve this, one requires high yielding crop varieties, fertilizers and pesticides. As the crop yield increases, there is greater incidence of pest attacks, leading to increased demand for pesticides. The conventional group of insecticides have several major dis-advantages, ranging from high dosages per unit crop, drift, and operational hazards to residues in the environment, plants and marketable produce. They also affect non-target vegetation and non-target organisms. This premeditates the need for the development of an alternative to overcome the lacunas of traditional pesticides.

The development of a new scientific area, nanotechnology has led to the development of nano-pesticides. Nano-pesticides are plant protection chemicals, in which either the active ingredient or the carrier molecule is developed through nanotechnology, i.e. in nano size. Several formulations viz., nanoemulsions, nanosuspensions, controlled release formulations, solid based nanopesticides etc., have been developed by the research community.

The major aim in the development of nano-pesticides is to lessen the environmental hazards of a pesticide active ingredient through improving the efficacy of a chemical. The absolute small size of the particles is the benefit here. The size of a nanoparticle generally range between 1-100 nanometers. These dimensions result in a large surface area, allowing for greater contact with pests, along with an increased permeability. Like other pesticide formulations, nanopesticide formulations consists of an active ingredient, a carrier molecule, and surfactants.

The mode of action against target pests is expected to be enhanced with nanoparticles, as opposed to bulk materials. Moreover, nano-formulations provide systemic properties, uniform leaf coverage and improved soil properties to support their constructive use in agriculture. Solid nanoparticles can also be used as nanopesticides. The inert dusts, such as silica, alumina, and clays cause damage to the wax coating on

the insect cuticle through both sorption and abrasion. This physical damage can result in the dehydration of the insect.

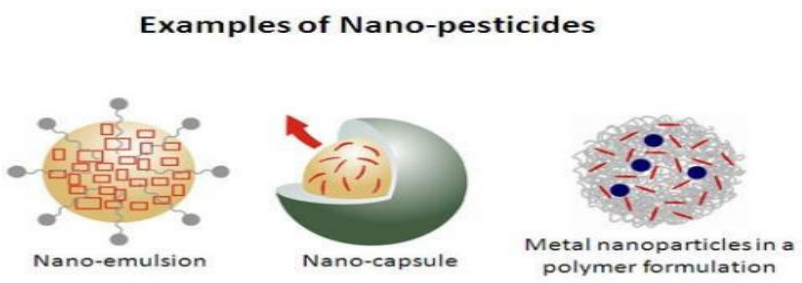
Nano-silica particles can be suggested as an eligible candidate among solid nanoparticles as they aid in increasing tolerance to abiotic and biotic stresses in the plant. However, they require high dosages for better results, which can adversely affect grain properties. Other nanoparticles with pesticide properties include Nanostructures alumina and nano-clays developed from montmorillonite. The latter also displayed a low toxicity

The major advantages of use of nano-pesticides over conventional pesticides are:

Nanotechnology offers a tool for developing novel formulations of eco-friendly pesticides as the majority of nano-pesticide formulations are highly target-specific.

Generally, targeted delivery and controlled release of nano-pesticides can improve pesticide utilization and reduce residue and pollution. For example, Nano-microcapsule formulations have slow release and protection performance because they have been prepared using light-sensitive, thermo-sensitive, humidity-sensitive enzyme-sensitive and soil pH-sensitive high polymer materials to deliver pesticides.

Nano-pesticides are extraordinary means for setting up an eco-friendly and sustainable agriculture system because they reduce the overall chemical usage, decrease the toxic residues and enhance the overall crop protection.



THE LIMITATIONS IN THE USAGE OF NANO-PESTICIDES:

• The risk that nanoparticles (nano-pesticides) may pose to human and environment health is not yet fully understood.

• Nano-pesticides may also create new kinds of contamination of soils and waterways since nano-pesticides are apparently much more persistent and have higher degrees of toxicity when compared to their traditional counterparts.

Therefore, a better understanding of the fate and effect of nano-pesticides after their application is required. It is a good thing that all necessary safety precautions are taken before deciding to go ahead and use new technologies on a large scale.

Avanthika S, IIIrd year ChE

RESEARCH REPORT:

Ionic Liquids As Solvents for CO_2 Absorption

With industrialisation, the effects of global warming are escalating day by day due to the emission of detrimental greenhouse gases into the earth's atmosphere. As per study, carbon dioxide (CO_2) emissions from the coal-fired power plants are the primary drivers of global warming, with the production of 4 grams of CO_2 for every gram of fossil fuel burnt. If this crisis goes unchecked, climate change could lead to profound human and ecological disruption.

Carbon Capture and Storage (CCS) technologies are emerging technologies that look to the stripping of CO_2 by a collection of strategies in various sectors such as automobile, petrochemical, chemical, and oil and gas industries. The three methods of carbon capture that are currently in development are pre-combustion capture, post-combustion capture, and oxy-fuel combustion capture. Of these, solvent-based post-combustion CO_2 capture process is the most straightforward scheme for the removal of flue gases by chemical absorption, by using aqueous blends of monoethanolamine (MEA) and ionic Liquids (IL).

Monoethanolamine (MEA):

Aqueous Monoethanolamine (MEA) is the commonly used solvent for amine-based post-combustion carbon capture through chemical absorption. Moioli *et.al* (2012) studied CO_2 capture using MEA and stated that the chemical absorption process is influenced by thermodynamics, mass transfer, and kinetics. The capacity of MEA in the CO_2 capture process is also dependent on its physical properties, namely pH, density, viscosity, and surface tension. Owing to its high absorption capacity, lower cost, and high reaction rate, MEA acts as a propitious solvent for CO_2 absorption. Despite its supremacy above other solvents, the used solvent components of MEA are volatile and also require a large amount of heat for regeneration during desorption, which brings the need of a better solvent.

Ionic Liquids (IL):

Ionic Liquids (IL) are salts in liquid state, which are completely composed of ions with a melting point below 100 C. Though ionic liquids are expensive, their high regeneration capacity and low volatility makes them significant alternatives in green chemistry. The unexpected popularity of ionic liquids is ascribed to their remarkable properties such as high thermal stability, negligible volatility, high CO_2 solubility, non-flammability, and tunability. The absorption capacity of ILs can be intensified by fine-tuning their physical and chemical properties. This can be achieved by the adequate and perfect selection of the cation and the anion constituents. Ionic liquids of imidazolium, pyridinium, and pyrrolidinium based cations along with fluoroalkyl-based anions show optimistic results in CO_2 absorption but fluorinated anions are expensive,

less reactive, and less thermally stable. Hence, ammonium based ILs are being used in study due to their low toxicity and inexpensiveness.

Absorption by aqueous blends of MEA and IL:

Recently research seeks to amalgamate monoethanolamine and ionic liquids to minimize the high viscosity of ionic liquids. The blending of MEA and ILs improves CO_2 solubility with a faster reaction rate. One notable ammonium-based ionic liquid used in carbon capture research is TetraButylAmmonium Hydroxide (TBAOH). The experimental studies include the testing of absorption capacity with 30 wt.% of blended solvent by changing the composition of each component.

The solvent-based post-combustion CO_2 capture process comprises CO_2 absorber and stripper and other ancillary units such as heat exchangers, pumps, and mixing tanks. Flue gas from the coal-fired power plant is first cooled to 40 C and then passed to an absorber where a counter-current stream of blended solvent chemically reacts with CO_2. The CO_2 absorption is comparatively higher when the weight composition of IL is significantly lesser than that of MEA.

Desorption and Solvent regeneration:

The CO2 rich solvent is heated to about 100 C in a cross-heat exchanger and further heated to 120 C at a pressure approximately 1.8 bar in a stripper. A blend of MEA and IL requires moderate heat of enthalpy for desorption. At the cited temperature and pressure conditions, the chemical reaction is reversed, resulting in the release of captured carbon dioxide. The CO2 lean solvent at the bottom of the stripper is regenerated and pumped back to the absorber and the overhead steam of 99 wt% of CO2 is compressed and transported to sequestration sites through pipelines.

The Bottom Line:

The versatility and inherent advantages of ionic liquids in the process of CO_2 capture are giving rise to a promising and expansive field. Though they are expensive, the increasing research and commercialisation of ionic liquids is set to decrease the initial cost of the solvent. Research based on blending of ionic liquids with monoethanolamine is considered to bring about constructive effects in dwindling the amount of carbon dioxide released from coal-fired power plants.

-Sharon Jose RB, IIIrd year ChE

INTERNSHIP REPORT:

Internship at St.Gobain

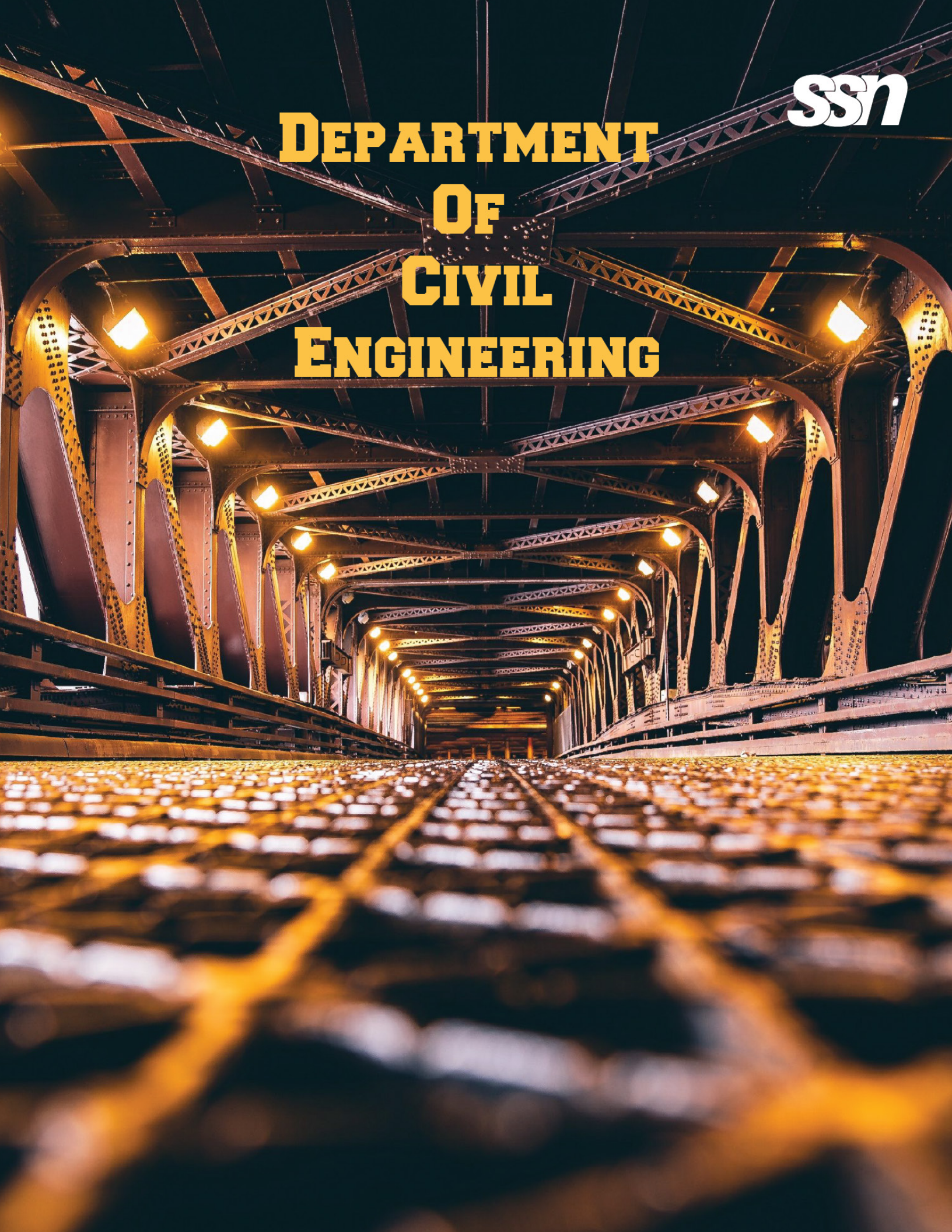
I was informed that amongst the many core companies that hired interns from our college, Saint Gobain was one of the best. Well, now I can say that indeed it was a thrilling experience! Unlike other internships, this was an in-plant internship, which meant that I had the opportunity to work in the plant for two months. Chemical engineering has always been my passion and I was glad to have an opportunity to learn what a plant would look like and how working in a plant would be. In additional to a stipend, there was a lot to learn from the internship. The system around which Saint Gobain works is beautiful. It brings out the best of an individual and always aims in maximizing one's time and effort.

One of the biggest draws for an employee or an intern come from the fact that the management is always open to ideas and work constantly towards improvement. I was given complete freedom to decide the methodology and time scheme of my project. Moreover, I was allowed to visit the float line (where glass is manufactured) frequently to further cement my knowledge on the process. Overall, it was an amazing experience overall and I am grateful to have had the best guides to help me complete my project.

INTERN- An Overview

I caught the company's bus at 6:30 AM every morning, and would reach the factory by 8:00 AM. After breakfast, I would go to my workspace where I had a daily meeting with my guides before I started my work. In this meeting, I had to summarize my previous day's work and they would give their inputs and suggestions. My project was research-oriented and hence, I studied several articles to better complete my task. My knowledge on thermodynamics and heat transfer was put to test, and I found myself constantly revisiting important concepts of the two subjects. I also had the opportunity to learn process simulation to better complete my project. The experience was quite challenging, and I had to give my all to cope with the workload. However, with the help of my guides and my team leader, I was able to move in the right direction and I came up with an optimal solution. I can now say that hard work pays off and challenging yourself to achieve your goal is all that matters. I also learnt to stay focused on my work and to trust the process, and to never give too much importance to the result I would take this opportunity to thank my college for giving me this wonderful experience and I hope that more students use these once-in-a-lifetime opportunities to their advantage. I must add that the professors of my department were instrumental in the creation of this opportunity. I would also like to thank my placement coordinator and the head of my department for bringing in such wonderful companiesfor internships and placements. Lastly, I thank my parents who have been supportive throughout and unconditionally helpful.

-Dhakshin Shravan Ramgopal IVth year ChE



Department Of Civil Engineering

From the HOD's Desk

Department of Civil Engineering

The world has forever changed because of the Coronavirus pandemic that hit us in 2020. Everyone is still recovering from the lasting effects of the Pandemic in 2021, while also being in constant vigil against subsequent waves of the virus. The transition towards online learning was a difficult one but both the student as well as the teaching community made it happen by adopting new technologies brought to the fore because of the Pandemic. Just like the latter half of last year, we were very active in the first half of this year as well.

I am happy to report that we, the department of Civil Engineering, had organized a number of events on a wide gamut of topics both academic as well as extra-curricular, in the past semester. This includes two international conferences on 'Applied Mathematics and Civil Structures' organized in association with Mathematics department in February 2021 and 'Sustainable Practices and Innovations in Civil Engineering' in March 2021. I am also extremely pleased to let you know that the department of Civil Engineering, SSN College of Engineering has signed a memorandum of understanding with Central Building Research Institute (CSIR-CBRI) under the Council of Scientific and Industrial Research, Government of India for student internships and projects. Both our teaching faculty as well as non-teaching staff members have constantly engaged in knowledge upgradation during these testing times and have equipped themselves better to face the future. I am also happy to report that our students were also engaged in delivering sharing sessions wherein they brushed up on topics in Civil Engineering handbooks and delivered lectures to their peers for improving their field knowledge. Our Alumni have also been actively in touch with us due to the paradigm shift in the way we meet and interact and have taken active part in the growth of the department.

I sure do hope that the upcoming academic session in 2021 offers us a better chance to make the best of what we have learned during the pandemic and develop an optimized blended system of learning for better knowledge sharing.

Dr. N. Sivakumar
Head of Department
Civil Engineering

Technical Articles:

WAVY WALLS USE LESSER BRICKS OVER STRAIGHT WALLS!

"Scientists investigate that which already is; Engineers create that which has never been."

– Albert Einstein

"Nothing is built on stone; all is built on sand, but we must build as if the sand were stone"

We all know that civil engineering is a world of innovation. There are lot of `technology in today's era. But most of the techniques that we use today in construction of many great structures are inspired from ancient world. For example, shinbhashira (a central pillar) of ancient Japanese Pagoda structure is inspiration to central tower used in Tokyo sky tree.

Walls are important component for any structure built. Now we are going to know about one of the innovative ancient wall structures called Wavy walls. Wavy wall also known as crinkle crankle wall or serpentine wall or sinusoidal wall. As the name indicates these walls are in the shape of wave (an alternate concave and convex curves). They are popular in European nations like England from 18th century, not only just because of their beautiful aesthetics but also because of many structural uses.

History of wavy walls:

These kinds of walls are mostly seen various parts of United kingdom, we can see them as garden walls and compound walls in many of the historical structures of England, especially in the East Anglical county of Suffolk, which boasts over 50 such walls dating back to the 17th century. It is believed that the word "crinkle crankle" is derived from Suffolk's dialect. Some claim that it was these English walls that served as inspiration for Thomas Jefforson, the third president of the United States, for the serpentine walls found in the University of Virginia.

Figure 1 Serpentine wall in Virginia University

Interestingly, these walls were even found on recent excavations of the western bank of the river Luxor and have been nicknamed "the rise of Aten". The walls, believed to be about 3500 years old, are over 10 feet high and made of mud bricks.

Figure 2 Wavy walls found in ancient Egypt city

Benefits over straight walls:

Contrary to what we might assume, wavy walls not only use a single brick thickness, but require less bricks than their straight counterparts.

Traditional straight compound walls use multiple layers of bricks to maintain stability – in fact, these walls would collapse without the extra layers. But the alternate convex and concave shape of wavy wall helps the wall to stand still even with less thickness/ single layer. They are also more resistant towards the lateral forces like wind pressure and other outward forces, thanks to the sinusoidal shape and arch support.

The English built these walls from east to west in their gardens so that one side was always under sunrays.

In terms of long compound walls and garden walls, use of crinkle crankle wall reduces the over all construction cost as they use less construction material. They are more durable, as evidenced by those which have survived for centuries, and have the added benefit of increasing the aesthetics of the structure.

Grandhe Vishnu Prathap, 3rd year, CIVIL

AMBIENT INTELLIGENCE IN CIVIL ENGINEERING

Integration of technology into daily life is a field that has generated great interest in the modern world. Ambient intelligence (AmI), marks a milestone in this field- AmI is generally sensitive and responsive to the people around, is an environment predominantly made of sensors and sensor networks and aims to bring intelligence to the environment we live in.

It involves a system comprising of the sensors and sensor networks, pervasive computing, and most importantly artificial intelligence. It makes computing available to everyone in a non-intrusive way, thus minimizing explicit interaction and enhancing quality of life.

Recently, AmI has been extensively used in Civil Engineering, with the aim of providing comfortable, ambient, and enhanced living to the people through technologies such as Smart homes, where the environment is aware of people's needs and can interact with people non-intrusively.

How does AmI work in buildings?

AmI consists of several hidden intelligent interfaces. These interfaces involve three basic technologies: Ubiquitous computing, ubiquitous communication, and intelligent user interfaces. To achieve AmI, sensor networks are integrated into the building's doors,windows,etc.

This sensor network comprises of various sensors (for example, heat sensors installed in windows, which also help in thermal insulation) which enable ubiquitous communication. This creates a platform for the components to interact with each other. The intelligent user interfaces allow the user to convey their needs as well as to control the computing system.

Smart buildings: A standing testimony!

Smart buildings are perfect examples for AmI in daily life. They extensively use AmI and are automated to various processes, such as to automatically control the ventilation, heating, air-conditioning and perhaps, most importantly, security. They even boast enhanced energy-efficiencies and user comfort. These concepts have even been integrated into hospitals, highways, etc.

Modern research focuses on integrating AmI with the practical applications of civil engineering. It even has scope outside of building construction, with applications in bridge engineering, geotechnical

engineering, underground engineering, road engineering, geological exploration, etc, thus providing a greener approach in all possible ways and greatly benefitting the discipline of Civil Engineering.

Sathya Shree T R, 2nd year, CIVIL

INTERNSHIP REPORT:

Organisation: *L&T Construction, Manapakkam, Chennai*

Internship period: *January 02, 2021 to April 15, 2021*

Title of the project work: *Project scope uncertainty and cost contingency assessment using PDRI*

Information about company:

L&T Construction is a division of Larsen & Toubro (L&T) a major Indian technology, engineering, construction, manufacturing and financial services conglomerate, with global operations. L&T addresses critical needs in key sectors - Hydrocarbon, Infrastructure, Power, Process Industries and Defence - for customers in over 30 countries around the world. With over 8 decades of a strong, customer focused approach and a continuous quest for world-class quality, they unmatched expertise across Technology, Engineering, Construction, Infrastructure Projects and Manufacturing.

Internship summary

Project scope definition, the process by which projects are selected, defined and prepared for definition, is a process necessary for achieving excellent project performance and is a key element in the pre-project planning process. The scope of a project in general is defined to provide all the stakeholders with a clear understanding of why the project was initiated and defines its key goals. If the scope of a project is poorly defined, the probability of its relative failure is comparatively high. Although the project scope definition should be done during the initiation of the project, it becomes necessary to identify whether there are any changes to the requirements for the project. Project Definition Rating Index (PDRI) is an efficient scope assessment as well as project scope definition tool developed under the guidance of Construction Industry Institute (CII) designed to increase the likelihood of project success by improving project scope definition, specifically by identifying deficiencies in scope definition early during the front-end planning process. This tool has been used for assessing the scope of the cooling tower of Kakrapar atomic power station (Phases 3&4). The tender documents for the project were thoroughly studied and 68 relevant elements were selected out of total 70 elements defined by the Construction Industry Institute (CII). The bid estimate was calculated based on data

from the tender documents. The elements were designated as high rated or low rated elements, allocated weighting factor based on designation and allocated appropriate maturity values based on relevant data from the tender documents. The total scores were then calculated. The uncertainty range was then determined by using the accuracy class developed by AACE. Monte Carlo Simulation was then performed and the Uncertainty Reserve Volume (URV) was determined. The project has been divided into 5 phases namely initial tendering phase, final tendering phase, initial planning phase, detailed planning phase and nearing end of construction. The PDRI score calculation and Monte Carlo Simulation were carried out for all the 5 phases and URV was found to be 6.82%, which is higher than the conventional .

The PDRI score calculation and Monte Carlo Simulation were also performed for various other test cases. Weighting distributions such as 80/20, 70/30 and 60/40 were compared and it was found out that the 3 distributions gave similar results. Different trends in variables like PDRI Score, initial estimate, final estimate, previous URV and URV were explored across the different project stages. Cumulative probability and probability density graphs for different project phases were plotted and mean of the distribution and overrun were determined. The regression analysis was performed for the 5 phases using the Statistical Package for the Social Sciences (SPSS) software with the URV as the dependent variable and it was found that data points are valid and reliable.

Anne Sherin S, Rebekah Rubidha Lisha R, Supraja G, Vinothni S N

RESEARCH REPORT:

Evolution of Building Materials

"Architects and engineers are among the most fortunate of men since they build their own monuments with public consent, public approval and often public money."

-John Prebble

The materials that we use for constructing houses, offices and commercial buildings are classified as building materials. Innovation in building materials appears to advance as civilizations advance, not so much in their knowledge and technology but according to the requirements of the society. That explains why advances in other technologies such as transport, medicine etc. evolves at different rates compared to building materials. In the last hundred years the development of business and commerce has led to the need for several high rise buildings.

Construction materials used in the early years included rocks, clays and other materials. Clay was the primary substance used to bind the gap between stones and bricks. Clay and mud were the most common materials used for construction. Wood was also used by people in the olden days to build their houses. Wood was not only used for the construction of houses but also for furniture such as tables, desks, chairs etc. Fast forward to present day, the most common material used for construction is concrete. It is a mixture of sand, gravel, cement and water in right proportion. It is durable and stronger compared to the wood and mud houses of the past. Another material most commonly used nowaday the construction process is metal. Large mansions and offices are build using metals which are typically strong and last a lifetime.

Let's take a look at the timeline when some of the most popular building/construction material were invented:

10,000 BC- First Earth and stone built shelters appear.

5,000 BC- Introduction of timber carpentry to supplement the use of stone.

2,500 BC- Glass; The Egyptians provided the first examples with silica and calcium.

2000 BC- Fired brick- First appeared in Middle East.

1500 BC- Steel; was first developed in Eastern part of Africa.

100 AD- Clear Glass; The Romans invented the first modern day glass.

1540 AD- Sand Casting- The process involves casting with molten metal.

1790 AD-Coke based Iron Smelting-This brought about the 1st Industrial Revolution.

1845 AD- Portland cement was invented.

1846 AD- Hydraulic cranes were invented.

1855 AD- Bessemer process of Steel production.

1867 AD- Reinforced Concrete – The revolutionary structural construction material.

1913 AD- Stainless steel was invented.

1926 AD- PVC – the most commonly used plastic came into existence.

1952 AD- Fiber Optics

By the end of the 20th century, ecology, energy conservation and sustainable development had become more important issues of construction. There has been a greater emphasis on the development of sustainable buildings also known as green building. It typically involves the application of eco-friendly, resource-efficient construction process designed to reduce the overall environmental impact of a structure throughout its lifetime. Construction and other activities associated with it can have a direct and indirect impact on the environment. Sustainable buildings such as green buildings, Pre-fabricated buildings and also buildings designed with the help of BIM can seek to reduce the effects and negative impacts it can have on the environment.

The evolution of construction materials has taken a slow and steady pace over the centuries. Compared to other branches of engineering and technology, the evolution of construction and its materials have been on the slower side. Civil and construction is one of the last major industries that are yet to be totally integrated with technology. The future holds exciting opportunities that includes augmented reality, Virtual reality, 3D printing and much more. Our generation of civil engineers will witness the transformation and integration of civil and construction practices and its methods from conventional to modern.

Vishal M

Department Of Computer Science Engineering

From the HOD's Desk

Department of Computer Science Engineering

This year is unique in seeing two editions of the annual joint technical symposium INVENTE, one in the month of January (the delayed 2020 edition) and the current one. The Covid-19 pandemic has transformed the educational institutes and workplaces permanently. It looks like the hybrid mode is here to stay even in the post-pandemic period. This technical event provides a wonderful forum for networking with industries and students from other colleges, honing the organising skills, leadership abilities and people management skills. This holistic development is essential for every student when they step out of college and enter the professional world. Adapting to emerging technologies and quickly becoming productive, navigating the plethora of tools and frameworks within a short period of time, ability to work independently and also as a part of a team will make the students invaluable to whichever company or industry they are joining. INVENTE definitely plays a key role in shaping the students in all these dimensions. I appreciate the office-bearers and the faculties-in-charge for introducing an interdisciplinary hackathon this year called Dev-a-thon. This will facilitate students to look beyond their respective disciplines and think about creative and innovative ways of combining their knowledge from multiple disciplines to solve scientific/societal problems of significance. I thank StayFlexi for sponsoring this hackathon. I also thank Facilio, Saama Technologies, TypeSense, Cosmic. Emids, LeanKloud, Motorq and other sponsors for their support. I appreciate the technical team for introducing new events such as Dev Heist, Code Triathlon, Relay in Reverse and GameNite this year in addition to the all-time favourite events such as CodOlympics, Paper Presentation and Hackers Asylum. I appreciate the CSE team for their creditable efforts in creating a nice website for the event. I congratulate the whole team for their efforts and wish the event every success.

Dr. Chitra Babu, B.E.,M.E.,M.S., Ph.D

Professor & Head

Department of Computer Science and Engineering

Technical Articles:

UNDERSTANDING INTELLIGENT SYSTEMS: EXPLAINABLE AI

The hype, excitement, and angst around Artificial Intelligence (AI) in today's world is something that couldn't possibly escape our attention. The dramatic success and the rapidly expanding momentum of AI in recent times have achieved a torrent of applications in diverse fields to deal with the increased complexity, scalability, and automation.

Concurrently, however, a rapid surge in the complexity and sophistication of AI-powered systems has evolved to an extent where humans do not really hold a firm grasp over the exact complex statistical correlations at play, using which AI systems work and make certain decisions — particularly when AI-based systems compute predictions and suggest decisions that are unintuitive and wildly confounding. Deep Neural Networks (DNNs), which dominate the modern-day learning systems, is example of this fact. DNNs are essentially complex architectures of mathematical functions learning high-dimensional correlations between their inputs and output. The architecture quickly fades into an opaque decision black-box as the networks grow deeper, albeit a highly operative and effective one. And that's not a very surprising observation. Developed with the structure of the human brain at the core of its ideation, it started, after all, as an attempt to recreate the abilities of the human brain without having anything close to a thorough understanding of how the human brain works!

The inherent element of ambiguity in AI models has certainly had a hindering effect on its adoption and reliance and there is a growing need for transparency and explainability in AI systems. The lack of explainability has led to the notion in some that AI cannot become commonplace in critical applications without people being able to reasonably trace how it is formulating its decisions and arriving at conclusions. This is crucial to attribute trustworthiness and legitimacy to AI systems, especially in applications that could mean the difference between life and death. Among critical applications including defense, law and order, and autonomous driving vehicles, medicine is perhaps a prime example — while there have been extraordinary advances in using AI systems for diagnosis and treatment formulations, they're seldom put into practice because they're not completely trusted by medical experts.

There has been a largely dichotomous approach to dealing with the abstraction associated with such black-box models — researchers who are satisfied with rigorous testing of the model as proof of its robustness and those who believe in the existence, and therefore the pursuit of the reasoning ingrained in AI models. The latter approach has marked the recent shift in scientific interests towards Explainable

AI (XAI). It emphasises on describing an AI model, its expected impact, and potential biases, thereby attributing transparency to its decision-making process.

The Explainability of a learning model becomes less apparent with increasing complexity. Resorting to deep-learning parlance, explainability may be crudely described as the knowledge of what one node represents and how important it is to the model's overall performance, and how influential it is at a choice point. The intricate statistical associations that the neural network makes between the features of the input and the final decision or a value output become apparent and interpretable with XAI.

In addition to formulating a more trustworthy and transparent model that is better-suited for high-stakes domains, XAI can play a pivotal role in debugging and eliminating bias in learning models. Recent incidents have demonstrated that understanding the model's decision-making rationale can aid early elimination of potential ambiguities and incorrect correlations that the model may infer, but are conspicuous to the human engineer analysing them.

In early 2020, one of Google Vision Cloud's algorithms reportedly produced "racist" results — it labeled an image of a dark-skinned individual holding a thermometer as a gun, and a similar image with a light-skinned individual as an electronic device. Further analysis revealed that an inadvertently larger proportion of violence-depicting training images featuring dark-skinned individuals may have led to such a correlation. Regardless of the reason, an XAI model would have revealed such a bias by demonstrating the importance attributed to the "race" feature in images and the racial bias could have been eliminated at a much earlier stage.

A similar case of bias was also observed when Facebook's AI refused to let an Instagram user from Brazil advertise a picture, arguing that it contained weapons when in fact, it was just a drawing of a boy and the Formula-One driver Lewis Hamilton. Evidently, this was a racial bias too! It is clear that such biased correlations are common and XAI can be key in diagnosing them early.

In recent times, explainability has transformed into a core matter of interest in the AI field and is actively evolving. New approaches and toolkits to achieve XAI are being introduced more frequently than ever, and for good reason. Large organizations have started adopting such approaches for their products. The COVID-Net neural network, for instance, was analyzed using XAI techniques by DarwinAI Corp. to gain deeper insights as well as to validate the model's ability to detect COVID-19 from chest X-ray images. It seems likely that XAI will provide the much-needed understandability and transparency to bridge the gap that hinders AI-based solutions from becoming practicable in high-stakes scenarios.

By Karthik D, 3rd year CSE 'A'

HOMOMORPHIC ENCRYPTION DECRYPTED

Today's world is flooded with data, both structured and unstructured, and the mere possession of this commodity is not enough. Privacy and monetisation are major concerns, hence encryption is employed to protect data in transit and data at rest. Traditional cryptography techniques require our data to be unencrypted in order to be processed correctly. This means that at some stage on a system we have no control over, our data will be processed in plaintext, susceptible to cyberattacks. Homomorphic encryption or specifically, fully homomorphic encryption is a viable solution to this problem.

Homomorphic encryption, commonly touted as the holy grail of cloud computing, is the conversion of data into ciphertext that can be used in complex mathematical operations without compromising the encryption, thereby maintaining data integrity. This isn't an entirely new concept, but it has taken some time to become practical. A homomorphic cryptosystem is like any other form of public encryption in that it uses a public key to encrypt data and allows only the individual with the matching private key to access its unencrypted data.

The two types of homomorphic encryption are partially and fully. A single operation, say addition or multiplication can be performed on ciphertext in partially homomorphic encryption, whereas fully homomorphic encryption can perform multiple operations, currently addition and multiplication, allowing more computation to be performed on encrypted data.

The problem statement was originally proposed in 1978, and laid dormant for more than 30 years as a viable solution seemingly unattainable to put into practice. A theoretical algorithm in 2009, published by a college student Craig Gentry, was the first plausible solution but wasn't practical as even a single bit operation took about 30 minutes, which is a trillion times longer than an unencrypted calculation. His idea soon sparked a research explosion. Owing to the extreme difficulty of the problem, researchers have looked at various sub-problems that are more tractable. Such a reduced system produces the partially homomorphic encryption. For example, the Levieil–Naccache scheme supports only the arithmetic addition operation, and the Goldwasser–Micali scheme supports only the exclusive-or bit operation. But the ultimate goal is a practical, fully homomorphic encryption system.

Many industry, academic and government research labs are working on making practical homomorphic encryption a reality. Microsoft has created a C++ code library named SEAL (Simple Encrypted Arithmetic Library) that can implement homomorphic encryption demos. Microsoft also created a .NET code wrapper over SEAL so that engineers can easily experiment with homomorphic encryption, without having to deal with the hassle of using C++.

The SEAL demo has two components. The first component is a service that runs locally and simulates a cloud service. The second component is a GUI client. In the demo, the user inputs data for two, 2x2 matri-

ces. The data is homomorphically encrypted and sent to the service. The service computes the matrix sum of the encrypted data and then sends the encrypted result back to the client. The client decrypts the result and displays it. The code is open source and fully available.

Google has also created a C++ code library called Private Join and Compute (PJC). Although PJC can perform computation on homomorphically encrypted data, the target usage scenario is SQL-like data join operations. For instance, if Company X provides a database of customer information with Social Security Numbers as keys to Company Y which has payment details and the same keys, Company Y can homomorphically encrypt their data and send it to Company X. Then Company X can combine the encrypted data and perform necessary computations without revealing the particulars from Company Y.

IBM has finally cracked the code and has released an FHE toolkit for Apple MacOS & iOS, ensuring that organizations can outsource data storage and computation without compromising data privacy or security. The toolkit is built on the HELib encryption library and includes sample programs to help organizations write FHE-based code. With this toolkit, an organization can convert plaintext into ciphertext that is unreadable by humans until an algorithm is used to decrypt it, after which computations are performed without human intervention and the results can only be decrypted by the data owner.

While homomorphic encryption promises to be an ideal solution to integrity, security, and privacy issues in cloud computing, it is currently a balancing act between utility, protection and performance. FHE has good protection and utility but poor performance, while PHE has good performance and protection but is very limited in its utility. Researchers however strongly believe that FHE is the solution and the neoteric breakthroughs are testament to the fact.

By Mrithula KL, 2nd year CSE 'A'

Research Report:

STATE BASED IoT SECURITY FOR TAMPER PREVENTION

Internet of things (IoT) is one of the fastest growing domains in technology, with widely increasing applications and research scope. It is said that right now, IoT is at its Golden Age with many companies and researchers focused on incorporating it. IoT is essentially a network of devices or 'nodes' which have software and/or processing abilities. These devices communicate and exchange information with each other via the internet. Generally, the information collected by devices in an IoT network are sent to their respective gateways where further processing can be done. IoT has silently made its way to the general population in the form of smart homes, smart irrigation systems, smart cities and so on.

Naturally, with newer technologies come new ways for people to exploit them. Owing to this, the cyber security domain is also presented with the challenge to protect the IoT devices and gateways. IoT devices are known for being lightweight and having less processing power, making them an easy target for a security attack.

Blockchain has also seeped into the world of security, including security for IoT devices. Blockchain, in its simplest terms, is a decentralized, distributed ledger technology that records the provenance of a digital asset. This also means that the data entered in a ledger cannot be changed. The most common application of blockchain is Bitcoin. Since the ledger is immutable, the addition of nodes to a network and maintaining them becomes a more secure task. The only downside to this is the computational power required. Nevertheless, many researchers have taken inspiration from the concept and modify it to make it more lightweight and IoT scalable.

As in normal systems, IoT devices also have a protocol stack for communication. Each layer is susceptible to various attacks, the application layer being one of the most vulnerable layers. The application layer is vulnerable mainly due to the aforementioned limited processing power and memory, and as it is the layer closest to the consumer.

Hijacking nodes and/or tampering with the data are common application layer attacks. To prevent these attacks, an application level protocol is proposed. The proposed protocol has three modules namely the authentication module, the gateway module and the device module. The authentication module holds the biometric data of the owner of the network. Biometric verification is done before adding a node to the network. This prevents malicious nodes from entering the network and causing attacks from the inside.

The device module uses a "stateful transaction" to prevent tampering of data. In most networks like TCP and FTP, there is a stateless transaction, that is, the receiver does not retain session state from previous requests. Due to this stateless transaction, the concept of a handshake comes into play to make the connection between a sender and the receiver.

There is plenty of research being conducted on IoT devices specifically to secure these devices since types of malicious attacks on these networks can only increase over time. And it is important to know about the attacks beforehand to prevent them.

By Christina Eunice John, 4th year CSE 'A'

Internship Report:

Internship @ Google

By Vanathi G, 4th year CSE 'C'

Amidst a global pandemic, I never imagined that I would get the opportunity to intern at an amazing company like Google! It was a dream come true for me when I received the good news that I had been selected after a rigorous process. After clearing the online coding round, I had two rounds of telephonic interviews based on data structures and algorithms (DSA). At first, I was apprehensive about attending the interviews as I expected them to be very difficult and pictured some intimidating interviewers in my head. However, consistent practice always pays off and I was able to solve the questions. The interviewers were also amiable and patient which helped me come up with solutions in a relaxed manner.

Though my internship was virtual, it was a phenomenal experience! I had a smooth virtual onboarding process and I was assigned to work with an amazing team as well. I worked on automating a workflow in an internal tool by integrating Salesforce and Google Ads with the application. I designed and implemented an API to do this with the help of my mentor. As I had a lot of web development experience on my resume, I was matched to a team that worked on backend development. Apart from what I had to explore and learn to finish my project, I was also trained on how to use the various internal tools and frameworks available to make a developer's life easy. Everyday I learnt something new and it was exhilarating to work among such talented and motivated people.

Apart from the project work, several fun events were organized for the interns. We got to attend interesting and inspiring talks by various people in leadership positions across a variety of divisions in Google. We also had a "virtual" offsite where interns were divided into teams and we had a fun-filled day of games! There were several opportunities to get to know the other interns and to network with full time employees from all over the world. The culture at Google is one of a kind where everyone is extremely helpful to each other and even as an intern, I could speak up and my ideas were considered. Overall, the internship experience was truly unforgettable and words cannot express how happy I was when I received the PPO (pre placement offer) to continue working at Google after completing college. I had two rounds of relatively harder DSA interviews again before receiving the PPO recently in September.

Applying for internships and preparing to tackle the selection process in any year is definitely a daunting task. As I was a biology student in 12th grade, I really wanted to catch up to everyone else before college started. I started learning Python and tried solving questions on Hackerrank in my first year. I joined the coding club as well, upon encouragement from friends and seniors. This led to my participation in several coding contests like ICPC, Hash Code and other college technical fests.

I took the time to explore various fields in CS, hoping to find something I would gravitate to. I attended many workshops, wrote a review paper and even undertook an internally-funded project at SSN. Through this process of exploration, I found myself greatly interested in web development, and I did a few projects to hone my skills, such as a visualizer for an algorithm to solve the famous 8 queens problem. In my third year I started preparing for internship interviews by solving problems spanning different topics and on various coding platforms.

I'd like to thank the CSE department at SSN for encouraging me to follow my passion and the SSN placement drive for giving us the opportunities to intern at some of the biggest companies in the industry. Also, none of this would have been possible without the support and motivation from my family and friends!

Department Of Electronics and Communication Engineering

From the HOD's Desk

Department of Electronics and Communication Engineering

It is a moment of great honor and privilege for me to greet you as the HoD of ECE. Invente 6.0 is a national-level online technical symposium organized by the Association of Engineers, SSNCE, Chennai. The tech extravaganza has steadily grown in popularity over the years and has stood out as one of the finest symposiums in the country. The fest has been host to a mosaic of student-organized events which will help the participants explore the intricate fabrics of technology/engineering and this edition will continue the same. The success of Invente 6.0 is entirely reliant on the magnanimous efforts of the students and the enthusiastic motivation from the faculty. I acknowledge my hearty appreciation for all those who have worked tirelessly for the success of this fest. I sincerely wish that this regimen would continue to be instilled in the upcoming editions of this phenomenal event.

Dr.S.Radha

Head of Department

Information Technology

Technical Articles:

FIFTH GENERATION (5G) NETWORKS

Ever since the dawn of civilization, the exchange of invformation has been the pillar supporting mankind's quest for knowledge. Early attempts at long-distance communication involved people shouting off mountain-tops and domesticating pigeons to carry messages for certain recipients. The very first truly portable mobile phone was introduced by Motorola in the year 1973, which included features like push-to-talk and mobile telephone system.

Standardization of analog communication protocols ushered in the establishment of the first generation (1G) of mobile networks, which was highly popular in the last quarter of the 20th century. The second generation (2G) of mobile phones involved transition to the digital mode featuring an improved voice quality and SMS services. The third generation (3G) marked the beginning of an era of internet-connected phones. 3G also offered multimedia access and secured communication to all its users. The fourth generation (4G) was all about upgrading existing infrastructure and providing improved data rates over its predecessor. Though the world has already adopted this standard, much work is yet to be done to bring the entire population under the umbrella of 4G networks.

Even at such a time, the world has already begun its migration to a newer and much more efficient communications standard – the fifth generation (5G). This generation promises to offer never-before-imagined speeds with an ultra-low network latency. To put things in perspective, 3G offered speeds of up to 2 Mbps while 4G offers roughly around 5 Mbps. However, 5G can theoretically offer 20 Gbps, a 200% increase in data rate, a speed which is currently unmatched even by cable modems. From hosting AI to supporting massive IoT systems and facilitating interference-free communication for connected/smart vehicles, the use cases of 5G are beyond the limits of current mobile network generations. This is the reason behind the massive hype and public frenzy surrounding this phenomenon. 5G achieves all these by making certain fundamental alterations to the existing mobile networks' infrastructure.

Since the frequency spectrum is a finite resource, there is heavy contention among various stakeholders to own a certain band of frequencies, especially those from 800MHz to 2100MHz as these offer optimum data rates for mobile phones. Cell phone carriers usually employ a host of technologies such as CDMA or FDMA to extract every ounce of their allocated spectrum. However, all that is about to change with the advent of 5G as it unlocks previously untouched portions of spectrum.

5G can operate in two bands, one below 6 GHz and another above 24 GHz, the latter termed as millimetre-wave (mmWave). In comparison, 4G operates only upto 4 GHz. Another distinction is in the size of the antenna. While 4G requires dedicated mobile towers, 5G antennas are very much compact and can fit in places such as a lamp-post or a rooftop. These are the primary reasons behind its mind-blowing throughput and colossal improvement in speed. 5G also employs a new air interface termed as 5G NR (New Radio) which will offer better scalability and flexibility to the carriers.

It is fascinating to note that 5G is no longer in the incubation or prototyping stage, it is commercially available in 38 countries as of June 2020. However, the adoption of this new standard is marred by few major hindrances. While switching from 3G to 4G was just a matter of swapping the SIM cards, migration to 5G requires more elaborate procedures including replacing an old headset with a new 5G-compatible one. Several concerns have been raised with regards to the environmental impact of utilizing high frequency waves in 5G. Since the range of 5G is short by nature, a large number of antennas are necessary for acceptable coverage. Moreover, adoption of 5G would lead to a reduced battery life in 5G-compatible devices.

Despite all these challenges, 5G still continues to exhibit the greatest potential for the ever-increasing demand in the increasingly data-driven world. Technologies such as Artificial Intelligence, Internet of Things, Smart Cities and Connected Vehicles all depend heavily on seamless connectivity and 5G seems to be the best bet for it. Whatever be the case, it is very interesting to see how these new technologies evolve with 5G at its core.

Aakash Murugan IV year, ECE-A

EDGE vCOMPUTING

"In God we trust, all others must bring Data" - Edward Demmings

Data and the Cloud

Data is the lifeblood of the modern world. There is endless data generated everywhere around us every second of the day and this virtual flood of data is constantly changing the way we handle, store, process and compute information on a global scale.

We live in the age of ubiquitous cloud computing- which refers to different services through the Internet including tools and applications like data storage, servers, databases, networking, and software. The evolution of cloud and cloud computing can be traced all the way back to the rise of modern technology. With the emergence of personal computers, the arrival of SaaS (Software as a Service) companies and the explosion of media hosting and consumption online in the late 90s, "cloud" as a concept was already used to describe the growing digital sphere. Once Google and Microsoft entered the field, the cloud was everywhere. PaaS (Platform-as-a-Service), SaaS, and IaaS (Infrastructure-as-a-Service) became brand new industries and the usage of cloud exploded in the world, making its mark in every sphere of life from entertainment to education to healthcare. Amazon Web Services launching their cloud services, later followed by other big tech companies like Google, IBM and Oracle further revo-

lutionized data computing. The industry boomed and grew at an accelerated rate and change the way wealth was created, services were offered and the world was operated.

Why is Cloud Computing not enough?

The Internet of Things (IoT) is the network of devices that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. Massive amounts of data are being routinely generated from sensors and IoT devices operating in real-time which should be collected, stored, processed and analyzed. Traditional cloud computing structures rely on a centralized data center and everyday internet isn't suitable for moving endlessly growing real-world IoT data. Bandwidth limitations, latency issues and unpredictable network disruptions are all regular and pressing problems that have pushed companies to move towards an edge-computing architecture.

So what IS Edge Computing anyway?

Edge computing can be defined as a distributed computing model in which computing takes place near the physical area where data is being collected and analyzed. Rather than transmitting raw data to a central data center for processing and analysis, that work is instead performed where the data is actually generated. This infrastructure involves sensors to collect data and edge servers to securely process data in real-time on-site, while also connecting other devices to the network.

What makes Edge Computing better?

The problem with traditional data center infrastructure is that the number of devices connected and the amount of data generated is enormous and too fast to accommodate. Edge computing follows a simple logic- bring data centers to where the data is. It deploys servers and storage where the data is generated and hence can operate many devices over a much smaller and more efficient LAN where sufficient bandwidth is used by local data-generating devices.

This approach reduces latency (time needed to send data between two points on a network)

reduces bandwidth reduces congestion and server resources and provides more processing of data close to the source

Companies can improve efficiency by having the processing done locally, which reduces the amount of data to be processed in a centralized or cloud-based location. Edge computing can also be used in areas such as virtual and augmented reality, self-driving cars, smart cities and even building-automation systems that require fast processing and response. Edge Computing is set to play a huge role in meeting latency targets to deploy 5G- both designed to significantly improve the performance of applications and enable huge amounts of data to be processed in real-time.

What's in store for Edge Computing?

Edge computing offers several new exciting solutions and opportunities and its growth will be impacted by the evolution of IoT in the coming future. It provides several advantages over traditional network architectures and will continue to play an important role in companies and industries at large. By 2025, edge computing is expected to be four times larger than cloud and generate 75 percent of the world's data. The growth of real-time applications that require local processing and storage capabilities will continue to drive the technology forward in the coming years.

R Samyuktha, III year, ECE-B

INTERNSHIP REPORT:

MITACS Globalink Research Internship
Research Internship at Western University, Ontario, Canada

About MITACS Globalink Research Internship

Mitacs Globalink Research Internship is a competitive initiative for international undergraduates from all over the world. Top-ranked applicants participate in a 12-week research internship under the supervision of Canadian university faculty members in a variety of academic disciplines, from science, engineering, and mathematics to the humanities and social sciences from May to October each year. This international internship is fully funded and is available at over 70 universities in Canada. Further, Globalink Research Internship alumni interested in returning to Canada for graduate studies are eligible for the Globalink Graduate Fellowship. It is an initiative that provides $15,000 in financial support to former Globalink Research Interns who return to Canada for full master's or PhD programs, or Postdoctoral fellowships at any MITACS partner institution.

Selection process:

My selection into the admired and sought-after Mitacs Globalink Research Internship at Western University, Canada was something which I would not have imagined a year ago. I was a computer science student in my 12th grade and had always adored mathematics and computer science as a subject. However, I had chosen electronics and communication as my undergraduate studies, as I wanted to incorporate my knowledge into the rapidly evolving field of electronics. From my young age, I always had this intellectual curiosity of "what next", this continued in college as well. I wasn't sure of what I would like to pursue but kept exploring.

I had attended various workshops, webinars and interacted with lot of seniors who were very friendly and encouraged me to explore as many domains as possible to identify the area of my interest. As I continued my quest, our college had introduced Internally funded project (IFP) which assists students in doing research projects by providing funding to those who are interested. Dr. B Praba ma'am (Professor and HOD of the mathematics department) graciously accepted my request to collaborate on a project titled "Facial expression detection using Double Bounded Rough Neutrosophic Sets." As the project progressed, I learned that I enjoy research, particularly working on data and interpreting new and interesting insights.

As my exploration continued, I came across "MITACS Globalink Research Internship". It was an international internship and thousands of students would apply from not just India but from all over the world. I was skeptical about it at first, but I decided to give it a try.

The application period for this research internship began in August and ended in September. I had to enclose my transcripts for the semesters that I had completed, as well as my LORs, and I had obtained two stellar letters of recommendation for the same from Dr. B Praba ma'am and Dr. P. Vijayalakshmi ma'am (Professors, Department of Electronics and Communication Engineering), with whom I had started working on an NLP based Knowledge Graph project. My personal information, CV, and passport information were all required for the application. Finally, I had the choice to select seven projects and ranking them according to my preferences. Because there are over 70 universities and even more projects, selecting a project was the most crucial task. I had gone through each project in detail, looking at the skill requirements as well as the work of the students. I chose projects in the fields of data science, machine learning, and mathematics from two ambitious, three moderate, and two safe universities.

The process was like, the application would get submitted automatically after the deadline. Following that, time was of the essence, and I required a great deal of patience. It was only in the month of October that my application status was change to candidate under consideration and matching process took place. Subsequent to this, the professors from the 7 projects that I had selected, assessed my application and one of them had requested me to submit a Statement of purpose in response to some questions about my talents and interests that the professor had posed. After this process, my application was selected by Dr. Mohammed Reza Najafi, Professor, Western University, Canada for the project titled 'Probabilistic flood forecasting using teleconnection signals'.

The Mitacs Globalink Research internship usually happens on campus and involve students travelling to Canada. It was, however, deemed remote because of Covid pandemic. The matching process happens in 3 waves and once all of them were completed, I was requested to submit various forms confirming my internship and had finally obtained my Mitacs Globalink Research Internship confirmation letter.

Internship Experience:

My internship lasted around 3-4 months, with the first month consisting primarily of literature review. I had to read a lot of papers in order to understand the project's concept and come up with ideas and solutions. Following this, I started working on the data, analysing it, and developing a model that predicts the concurrent wet and dry events all over Canada, with the ultimate goal of predicting floods. Despite the fact that the internship was remote, I had a great time. There were mentors assigned from Canada to a group of people, and we had movie nights and various fun events planned for us. Various international workshops and seminars were held in a variety of fields for the intern students.

This internship taught me a lot, from dealing with real-time data to working in an international research environment. The experience was definitely a confidence booster for me and has added great value to my profile.

SSN has provided me with numerous opportunities to learn and grow. It has shaped me who I am today, bringing the best out of me. All because I took advantage of the opportunities and prospects posed in front of me. Patience, hard work and perseverance is all one needs to achieve any dream.

I would like to express my gratitude to SSN management and the principal, SSNCE for providing such opportunities. I would also like to thank all my professors for constantly guiding and motivating me to pursue my dream. Finally, I would also like to thank my parents, without whom none of this would be possible.

Pooja S, IV year, ECE-B

RESEARCH REPORT:

Convergence of AI in material and computer chip development

The Massachusetts Institute of Technology defines artificial intelligence as the quest to build machines that can reason, learn, and act intelligently. "I think artificial intelligence will likely change the character of warfare and I believe whoever masters it first will dominate the battlefield for many, many, many years" quotes Mark Esper. AI's progression has exponentially increased over the past decade and it is being used diversely in various fields. With the recent developments of state-of-the-art technologies, AI can be categorised as Narrow or weak intelligence, General Intelligence and Superintelligence.

Narrow intelligence can be defined as the machines that perform well for a defined set of tasks when exposed to rich sources of data. For this intelligence, learning can be either supervised or unsupervised. General Intelligence takes inspiration from human intelligence. It implies that these machines can understand complex concepts such as emotion, rational and irrational behaviours. It does not require supervised learning. Superintelligence refers to an intelligent system that rapidly increases its intelligence in a short time, specifically, to surpass the cognitive capability of the average human being. It is tied to the idea of "singularity", which is based on the idea that a catalyst or trigger would cause rapid change beyond what humans can anticipate. It plays a significant role in discussions about the ethics surrounding the usage of artificial intelligence and how to shield humanity from a potential runaway AI model.

Briefly understanding the classification, let us now shift the focus to the convergence of AI in two main domains where people thought AI can never be used for its advancement.

AI in advanced material development:

AI is no stranger to material science. It has been used in this field since 1990. During this timeframe, machine learning focused on pioneering new materials that are cheaper, lighter, stronger and may have versatile properties required for dynamic environments. In 2018, the University of Vancouver demonstrated the agility gained by using AI by driving down the material discovery, testing, and production process from 9 months to 5 days. As a part of the material development process, material availability is one of the foremost considerations in determining the timeline of the product until it reaches the market. Hence, manufacturers look for materials already available in the supply chain. Machine learning has optimised the management of the end-to-end supply chain by predicting the best suppliers, as well as alternative materials and designs with the corresponding suppliers. Start-ups like Centring Informatics uses a sequential learning platform enabled by AI to predict what materials can be used

in the design, as well as material availability within the supply chain. In situations where materials are not readily accessible, AI is beginning to be used to accelerate the identification of new prospects and extraction of these minerals. An Australian start-up named Earth AI demonstrated this ability to locate rare earth materials using predictive modelling machine learning built from layers of commercially available historical terrain information and satellite imagery. The use of AI has accelerated the identification of new prospects and extraction of these minerals. Added to that, AI is used in predicting the outcome of different combinations of materials.

Neuromorphic AI Computer Chip development:

Neuromorphic artificial intelligence (AI) computer chips, or AI chips, may be described as silicon-based wafers that emulate the human brain architecture, relying on intricate synaptic neural networks that evoke responses when exposed to certain stimuli. AI chips can do this because computational memory and processing are resident on the same silicon wafer, compared to traditional computing which separates the two. Furthermore, the latency of the synaptic signal transmission is significantly reduced because processing and storage are intertwined, which is similar to the human brain neuron network. Mike Davies, Director of Intel's Neuromorphic Lab, highlighted that this architecture enables neuromorphic chips to process complex cognitive games faster than some supercomputers. Intel's Loihi neuromorphic chip has been reported to make decisions on complex games like sudoku within 4 milliseconds, "100 to 1,000" times faster than the supercomputer used for the Human Brain Project. Also, neuromorphic chips, like Loihi, appear to be faster than the human brain for some tasks. Researchers at the University of Milan suggest neuromorphic chips may have the ability to process information faster than humans but lack the ability to learn dynamic, complex tasks. For machines, to replicate complex human tasks, researchers and major tech companies are aggressively pursuing the development of computing hardware and software that emulates human intelligence. Current neuromorphic chips learn through presentation of static information, rather than observing its environment and inferring actions from what is remembered. Neuropsychologists refer to this as episodic memory in the human brain, and requires interactions between the hippocampus and temporal lobes. Despite neuromorphic chips lacking episodic memory, technology giants NVIDIA, Intel, and IBM are partnered with neuroscientists to map the hippocampus, making this model available for integration into neuromorphic chips.

With researchers trying out different possibilities every day and many industries making huge investments in these cutting-edge technologies, the aforementioned convergence is likely to happen by 2025. As interesting as this convergence looks, it is likely that many fundamental questions could be answered with a solid reason: how human life originated, the mystery behind the formation of Earth and other planets, and what makes Earth sustain life.

Indu Subramaniam

4th year, ECE-A

Department of Electrical and Electronics Engineering

From the HOD's Desk

Department of Electrical and Electronics Engineering

INVENTE is the annual celebration of innovation and technology. The creativity and thought-provoking ideas of the young minds are brought to light in order to bring a change in the way things function. The association of Electrical and Electronics Engineers of the Department of EEE are proud to be a part of this grand technical symposium, Invente 6.0. This symposium is a technical conference which facilitates the interaction between like-minded people in making new innovations and fueling thought for change. Invente is conducted keeping in mind the above viewpoint and provides a great opportunity for the students to exhibit their prowess and talent as organizers and participants of the various events which will be happening. I appreciate the faculty and students for their valuable contribution to INVENTE 6.0. As the saying goes, "If we want to achieve success, then let us empower ourselves with the weapon of knowledge and let us shield ourselves with unity and togetherness." Hope we score better and higher in all our future endeavors. At this juncture I would like to extend my heartfelt wishes for the success of this event.

Dr. V. Kamaraj

Head of the Department

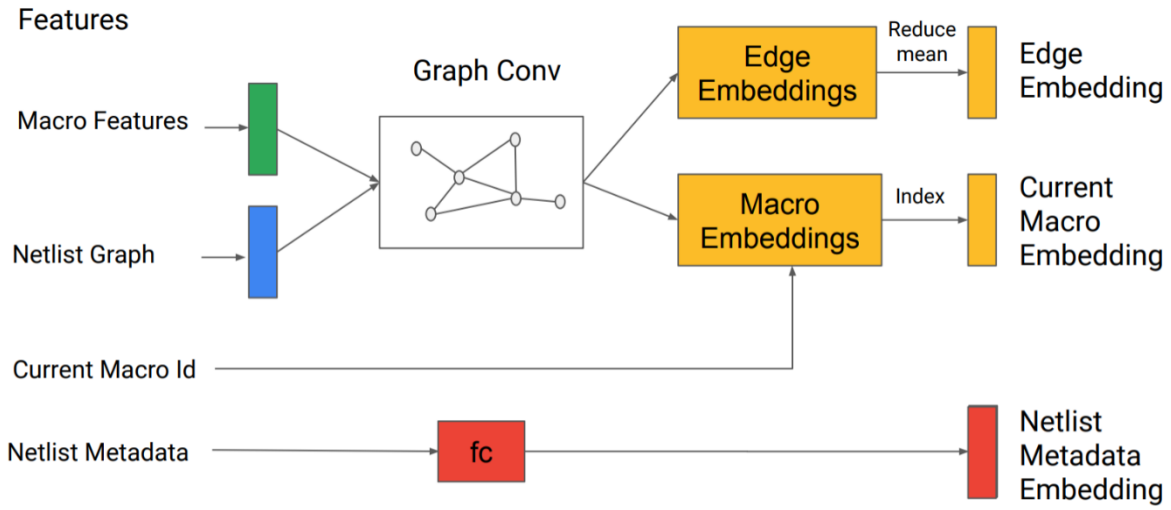
Electrical and Electronics Engineering

Technical articles:

Learning the ropes of automation in chip design!

What was once thought of as a long shot has been made into reality by Google. Ever wondered of using machine learning algorithms to manufacture the brains of your systems and devices? Yes, the smart cookies at Google have come up with a mind-blowing innovation wherein a processor can be designed and tested within six hours which is quite an improvement in the efficiency and the product manufacturing output. On an average, the chips take years to be designed, fabricated and tested. The need for optimizing the manufacturing time of the chip became necessary to supply the constantly increasing demand of customers worldwide.

The machine learning approach when incorporated in the design may significantly reduce the process time and aid in the development of hardware and AI in sync. The algorithm that was employed is the Reinforcement learning algorithm which has the ability to learn from the previous cases and improvise the solution to the problem given. The chip placement with reinforcement learning technique trains a variety of models and tames it to perform exceptionally well. This optimizes the placements of the previously unseen chip modules. It takes several weeks with a dedicated team of experts working endlessly to perfect the placements of the chip blocks which has been scaled down successfully to less than six hours by incorporating the ML algorithms.



The chip floor planning which the process of designing the layout of a chip block is the most tedious process of the whole design and fabrication process, which involves the positioning of a netlist onto the chip canvas, which in turn minimizes the power consumed, performance and area occupied. Until today, it has been a humongous process for the design experts in order to iterate and arrive at a solution for optimizing the chip floorplan which normally takes several weeks to reach the desired the design specifications. The complexity arises from the size of the netlist graph which has billions of nodes, the

granularity of the grid onto which the netlist has to be placed, and the huge cost of computing the true target metrics, which is a process that requires a lot of time even using electronic design automation tools.

This method is the first in its kind to leverage the approaches that it has learned in the placement of netlists to generate better placements of the new netlists. The performance of the method is dramatically increased as the number of training sets increase showing significant improvement and optimization in the placements. This new dimension in the process of chip design can open doors to the process of co-optimization of the chip design process and open endless opportunities in the paradigm.

Harshini J III -year EEE

Indian Problems need Indian Solutions!

It is a well-known fact that electric vehicles are going to be the future of the transportation. Sooner or later, everything is going to become electric. Countries like Canada have already banned the use of ICE cars and light weight trucks from 2035. India in definitely on its path to achieve zero emission.

Ambitious companies like Tesla expanding their business to India is definitely a big boost. But what we need are solutions that work for our conditions. Solutions that are specifically tailored to our circumstances.

A very good example of this is when the government wanted to distribute LPG to use as a fuel for cooking to replace firewood. The initial solution to that problem was that the gas can be delivered to every home through pipelines just like they did in the USA. Sounds simple. But the problem was that the population of India and America is vastly different. Implementing such a system is a hassle and a half. The solution to the problem was to deliver LPG through gas cylinders. Simple and most importantly it worked. That's what we need. Working solutions. Not fancy ones.

Tesla is designed specifically for roads in developed countries. In India the roads and the traffic conditions are different. And moreover, Tesla's options (at least for now) doesn't coincide with India's interests. 79% of our country's roads are filled with 2 wheelers. 4% for autos and 12% for economic cars (under 10 lakhs). These 3 together occupy 95% of the Indian roads. Tesla doesn't fall in any of the categories.

These vehicles in India doesn't need 600 kms of range. What Indian vehicles need is longevity and affordability. Definitely 600 km batteries are too expensive for an average Indian. By reducing the range, we can reduce the battery cost and both the problems will be solved, right? If only life was that simple. Reducing battery range will increase range anxiety. We definitely don't want to get stranded in the middle of nowhere. Then what is the way out of this problem?

It is the same solution that was implemented to distribute LPG throughout the country. Swappable batteries. We could have battery swapping stations like we have petrol pumps. People can come to this station and replace their empty battery with a full one. These battery swapping stations can use batteries with less range. So, it will be cheaper. They can collect a fee that includes battery cost, charging cost and usage cost (since the battery deteriorates after every cycle). For all these to happen there should be standardisation of batteries. These swapping stations can also have a special range extender battery that has a longer range

and is more expensive. They can be used to travel long distances. Building battery swapping stations is easier than developing a new charging network. Another advantage of battery swapping station is that the space required is less compared to charging stations. The battery can be charged at optimum conditions too.

Certainly, there will be better solutions to the problem. But the one thing we need to keep in mind is that what works for one will not work for another. Before making any decision, we must make sure that the solution was chosen because it works the best for our conditions and not because other countries are doing it. That has always been the Indian way (ISRO). Indian problems need Indian solution.

Vinu Varshath S 3rd year , EEE

THE SHEER POWER OF DISCRETE SENSORS AND ITS DATA FUSION IN THE RAFALE FIGHTER JET

-Sriharini K (EEE III)

Over the past few decades, the air force has always been the first military force engaged in all crises or conflicts, from the Falklands to the Gulf, from Bosnia to Kosovo, from Afghanistan to Libya, and more recently Mali, the Central African Republic, Iraq and Syria.

In modern warfare, air dominance from day one is a must, so that air-to-ground and air-to-sea operations can be conducted safely and efficiently. This significant role of the air force in modern warfare

is demonstrated by the defense strategies decided by those nations who want to keep a leading role on the world stage.

The Rafale, with its omnirole capabilities, is the right answer to the capability approach selected by an increasing number of governments. It fully complies with the requirement to carry out the widest range of roles with the smallest number of aircrafts.

The Rafale is the first operational – and so far, the only – European combat aircraft to use an electronic scanning radar. Compared to radars with conventional antennas, unprecedented levels of situational awareness are attained with earlier detection and tracking of multiple targets. In October 2012, the first Rafale fighter equipped with an "Active Electronically Scanned Array" (AESA) RBE2 radar was delivered to the French MoD. The AESA provides a wide range of functions from an all-aspect look-up and look-down detection and tracking of multiple air targets for close combat and long-range interception, in all types of weather conditions and in severe jamming environments to detect and track multiple naval targets.

In those situations where discretion becomes the single most important tactical factor, the Rafale can rely on several other sensor systems:

FRONT SECTOR OPTRONICS – FSO

Operating in the optronic wavelengths, the system is immune to radar jamming and it provides long-range detection and identification, high resolution angular tracking and laser range-finding for air, sea and ground targets.

SPECTRA – INTERNAL ELECTRONIC WARFARE SUITE

von combinations of radar jamming, infrared or radar decoying and evasive maneuvers.

The outstanding capability of SPECTRA regarding airborne threat localization, is one of the keys of the Rafale's superior situational awareness.

NET-CENTRIC CAPABILITY

The net-centric capability of the Rafale hinges on its open architecture, its data fusion software and its compatibility with a variety of data links, which "plug" the Rafale into the integrated battlefield.

A secure, high-rate data link is provided to share data in combined air operations in real time with other aircrafts in the formation, airborne and surface command and control centres, tactical air controllers or other friendly assets. The Link 16 data link is also available to those customers cleared to operate it.

As a net-centric capable asset, the Rafale can exchange images. The Rover ("Remotely Operated Video Enhanced Receiver") is an element of this capability which allows aircrews and forward air controllers on the ground to share videos or images of the target. It helps prevent blue-on-blue incidents and collateral damage, a decisive advantage in peacekeeping operations.

TALIOS – TARGETING AND LASER DESIGNATION POD

It brings full day and night surveillance and laser designation capability to the Rafale, with metric precision. It permits laser-guided weapons to be delivered at stand-off range and altitude.

The IR sensor of the Talios pod operates in the mid-wave infrared band and is coupled to a high-resolution new generation TV sensor. Talios is inter-operable with all existing laser-guided weapons.

AREOS – RECCE POD WITH QUICK ANALYSIS CAPABILITY

To shorten the intelligence gathering cycle and accelerate the tempo of operations, the AREOS pod is fitted with a data link which allows high resolution images to be transmitted back to military decision makers in real time. The outstanding performance of AREOS in stand-off reconnaissance makes it a sensor with a true strategic value.

What makes the essential difference is the Rafale's "multi-sensor data fusion" process running on data provided by all the sensors of the aircraft. In essence, the "multi-sensor data fusion" concept implemented in the Rafale allows the pilot to act as a true "tactical decision maker", rather than only being a sensor operator.

The core of these enhanced capabilities of the RAFALE lies in a "Modular Data Processing Unit" (MDPU. It is composed of up to 19 flight "line-replaceable units" (LRUs), with 18 of them individually providing 50 times the processing power of a typical mission computer employed in previous generation fighters.

The MDPU is the cornerstone of the upgradeability of the Rafale. It allows a seamless integration of new weapons and new capabilities to maintain the war fighting relevance of the Rafale over the years as tacti

cal requirements evolve, and as the computer industry keeps rolling out new generations of processors and software.

The "multi-sensor data fusion" provides a link between the battlespace surrounding the aircraft and the pilot's brain with its unique ability to grasp the outcome of tactical situations and make sensible decisions.

It hinges on the computing power of the MDPU to process data from the RBE2-AESA radar, the "Front Sector Optronic" (FSO) system, the SPECTRA EW system, the IFF, the MICA infrared seekers, and the data link.

DESIGN AND COMPREHENSIVE ANALYSIS OF SYNCHRONOUS RELUCTANCE MOTOR FOR AUTOMOTIVE APPLICATIONS

AKASH P from EEE, 3rd year

In the recent conference conducted by mechanical department of Sri Sivasubramaniya Nadar college of engineering on the topic "INTERNATIONAL CONFERENCE ON ENERGY AND MATERIALS TECHNOLOGIES (ONLINE)", I, along with Mr. Harish Babu, Mr. Babu Venkatesh and Mr. Sivaramakrishanan S under the guidance of Dr. Nagarajan V S sir and Dr. Rajini V mam presented a paper on the topic "DESIGN AND COMPREHENSIVE ANALYSIS OF SYNCHRONOUS RELUCTANCE MOTOR FOR AUTOMOTIVE APPLICATIONS". In this paper, we presented the design optimization and improvement in electromagnetic, thermal and vibrational performance in terms of average torque, torque ripple and higher efficiency through Sensitivity analysis and FEA of Synchronous reluctance motor for Automotive application.

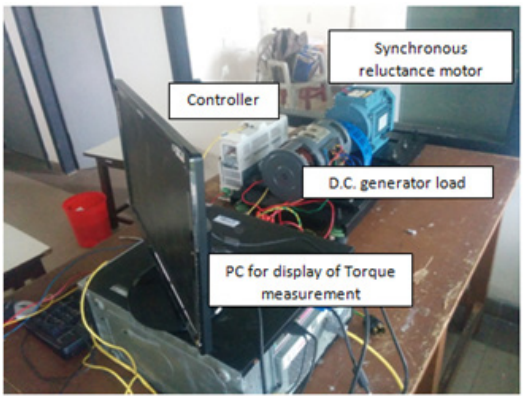
We kept the requirements as follows:

Torque ≥ 7 N-m

Efficiency ≥ 89%

Torque ripple ≤ 0.15 Nm.

For design optimization and choosing the desired parameters, Electromagnetic analysis was done, through which its average torque and torque ripple were determined. Once done, we chose initial bounds for our



parameters and sensitivity analysis was done. At the end of sensitivity analysis, we got redefined bounds for our design variables. Once we get these results, we combine the results of electromagnetic and thermal analysis and combine it into a single result. Finally, Von-Mises Stress calculations were done for vibrational analysis and the experimental valuation of results were undertaken. The FEA results and Experimental results are well in the range of accuracy and our requirements were met. The software used for Sensitivity Analysis and FEA analysis here are MotorSolve, MagNet and Ansys.

Last but not the least I take this opportunity to thank

SSN College of Engineering and the EEE department

for giving me this opportunity. ,

INDUSTRIAL TRAINING ON ELECTRIC VEHICLE

"KNOWLEDGE WITH ACTION CONVERTS ADVERSITY INTO PROSPERITY"

This Industrial Training was conducted by TVS Training and Services Ltd. It was a functional 5-day Industrial Training from 24th August to 28th August 2021. Each day started at 9 AM in the morning and ended pm everyday, filled with a lot of learning. Each day was broken into two slots consisting of practical sessions and theoretical explanation classes.

Practical sessions included some hands on experiments like -

Conventional Vehicle Assembly and Dismantling

Testing of EV Components

Controlling DC motor with MOSFET

Buck & Boost Converters

Induction Motor Control with VFD

Battery testing and design of Battery for EV

Assembling and Dismantling of EV.

Hands on experience on these experiments provided us an opportunity to learn and explore how our theoretical knowledge meets real life time applications on Electric Vehicles. The class room sessions encom

passed activities such as Case study analysis, Demonstration through animated videos and interactive Q&A sessions.

These were carried on the below mentioned topics:

Conventional Vehicle - Mechanical and Electrical Systems

Basics of EV Power-Train & Vehicle Architecture

Components of EV

Electric Motors & Control Techniques

Power converters and Energy Storage Systems

Types of Battery and its EV design

BMS

Challenges and policies of EV.

Since we the students were attending Online classes for so long due to this pandemic crisis, this offline Industrial Training on EV gave us exposure on new and innovative electrical ideas in a lively class room ambience. This 5 -day meeting allowed us to meet industrial experts and teachers, who were friendly and inculcated a lot of valuable insights to conceptualize the main objectives. This Industrial Training was not only thought provoking but also stimulated many creative ideas in the minds of the students. To sum it up, it was an outstanding and informative Industrial training. We are looking forward to attending many more such useful interviews to enlighten ourselves and sharpen our minds.

-Sarayyu M K III year EEE

Department Of Information Technology Engineering

From the HOD's Desk

Department of Information Technology

I am extremely happy to write this note for the sixth edition of INVENTE, an inter-disciplinary platform to showcase the converging technologies and their impact on society. INVENTE has been the most awaited event by students across the country and this year students of the IT department, along with their peers from other streams, are back with a set of technically challenging and fun-filled events on the 8th and 9th of October 2021.

I welcome the participants to enthusiastically showcase their gitty code talents, share their seed innovative ideas, and take home attractive cash prizes and internship opportunities. I congratulate the members of the Association of Information Technology (AIT), for meticulously planning and organizing the events that will help the participant to discover their technical and non-technical virtues. I wish the team and the participants to intellectually engage and make Invente 6.0 a grand success.

C. Aravindan
Professor and Head
Department of Information Technology

Technical Articles:

FUTURE OF NANO TECHNOLOGY

- Ghanta Sandhya Rani , IT – A , Fourth year

Nanotechnology can be defined as the science and engineering involved in the design, synthesis, characterization, and application of materials and devices whose smallest functional organization, in at least one dimension, is on the nanometer scale i.e one billionth of a meter. At these scales, consideration of individual molecules and interacting groups of molecules in relation to the bulk macroscopic properties of the material or device becomes important, as it has a control over the fundamental molecular structure, which allows control over the macroscopic chemical and physical properties.

Nanotechnology has found many applications in almost every existing field and this article outlines some such applications of nano technology.

NANO TECHNOLOGY IN THE FIELD OF MEDICINE:

Materials and devices can be designed to interact with cells and tissues at a molecular (i.e., subcellular) level for applications in medicine and physiology, with a high degree of functional specificity, thus allowing integration between technology and biological systems which were previously unattainable.

Applications of nanotechnology in the field of medicine includes fluorescent biological labels, drug and gene delivery, bio-detection of pathogens, detection of protein, probing of DNA structure, tissue engineering, tumor detection, separation and purification of biological molecules and cells, MRI contrast enhancement and phagokinetic studies. The long-term goal of nanomedicine research is to characterize the quantitative molecular-scale components known as nanomachinery. Precise control and manipulation of nanomachinery in cells can lead to better understanding of the cellular mechanisms in living cells, and to the development of advanced technologies for the early diagnosis and treatment of various diseases.

The significance of this research lies in the development of a platform technology that will influence nanoscale imaging approaches designed to probe molecular mechanisms in living cells. Molecular imaging has emerged as a powerful tool to visualize molecular events of an underlying disease, sometimes prior to its downstream manifestation. The merging of nanotechnology with molecular imaging provides a versatile platform for the novel design of nanoprobes that will have tremendous potential to enhance the sensitivity, specificity and signalling capabilities of various biomarkers in human diseases.

Drug bioavailability is a related problem with potential nanotechnology solutions. Nanotechnology is opening new therapeutic opportunities for many agents that cannot be used effectively as conventional oral formulations because of their poor bioavailability. In some cases, reformulation of a drug with smaller particle size may improve oral bioavailability. Nanoparticles formulations provide

protection for agents susceptible to degradation or denaturation in regions of harsh pH, and also prolong the duration of exposure of a drug by increasing retention of the formulation through bio-adhesion.

Another broad application of nanotechnology is the delivery of antigens for vaccination. Mucosal immunity is extremely important in disease prevention but continues to be limited by both degradation of the vaccine and limited uptake. Recent advances in encapsulation and development of suitable animal models have demonstrated that microparticles and nanoparticles are capable of enhancing immunization.

NANO TECHNOLOGY IN ROBOTICS:

Nanotechnology, the manipulation and assembly of tiny devices often not much larger than a group of molecules, is a perfect application for industrial robotics. Nanorobotics describes the technology of producing machines or robots at the nanoscale. 'Nanobot' is an informal term to refer to engineered nano machines. Though currently hypothetical, nanorobots will advance many fields through the manipulation of nano-sized objects. Due to the fact the objects being handled are so small, a few billionths of a meter, it is impossible for a human to see or successfully fabricate anything from them, robotics are the primary means of working with them.

Nano-positioning robotics are used in a variety of processes, including fiber optic component assembly. Semiconductor assembly, testing and inspection use robots for nanotechnology production. Also nanotechnology robots are used in high-density pharmaceutical assay processes.

Nanorobotics Applications for Cancer Detection and Therapy:

As cancer survival rates improve with early detection, nanorobots designed with enhanced detection abilities will be able to increase the speed of a cancer diagnosis and therefore enhance the prognosis of the disease. Nanobots with embedded chemical sensors can be designed to detect tumor cells in the body. Proposed designs currently include the employment of integrated communication technology, where two-way signalling is produced. This means that nanobots will respond to acoustic signals and receive programming instructions via external sound waves along with transmitting data they have accumulated. A simple reporting interface could be produced through strategically positioned nanobots in the body which are able to log information supplied by active nanobots traveling through the bloodstream. Instructions could be adapted in-vivo to provide active targeting for monitoring or healing.

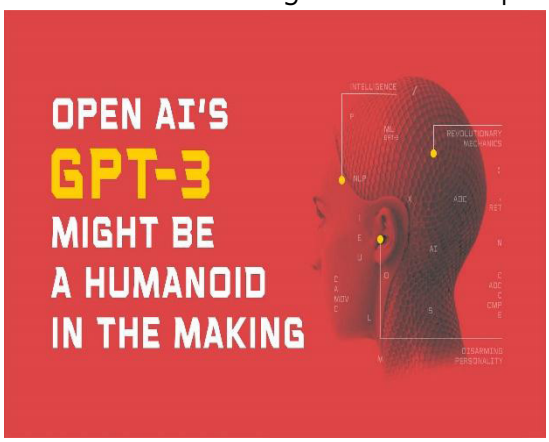
Thus, it is concluded that nanotechnology or systems is a multidisciplinary scientific field undergoing explosive development. The genesis of nanotechnology can be traced to the promise of revolutionary advances across medicine, communications, genomics and robotics.

The multidisciplinary field of nanotechnology is bringing the science of the almost incomprehensible small device closer and closer to reality. The effects of these developments will at some point be so vast that they will probably affect virtually all fields of science and technology. As such, nanotechnology holds the promise of delivering the greatest technological breakthroughs in history. Over the next couple of years it is widely anticipated that nanotechnology will continue to evolve and expand in many areas of life and science, and the achievements of nanotechnology will be applied across the fields of medicine, communications, genomics and robotics.

Codex- making coding easier

Codex is an AI system that translates natural language into code. Co-founded by Elon Musk, Codex uses GPT-3(Generative Pre-trained Transformer), a neural network machine learning model trained using internet data to provide any type of text. The infamous Github Copilot developed by Github in collaboration with OpenAI is used to assist users of Visual Studio Code by autocompleting code. GitHub Copilot draws context from comments and code, and suggests individual lines and whole functions instantly.

OpenAI Codex's training data contains both natural language and billions of source code generated from publicly available resources including code in Github repositories. OpenAI Codex helps the computer in better understanding of the human text to generate useful pieces of code from the internet.



Internet of Behaviour

Data collected from the internet provides valuable information about a person's behaviours, interests and preferences and this is called as the Internet of Behaviour. The IoB attempts to understand the data collected from user's online activity from a psychological perspective. The data is then analysed to providing the user a new user experience, search experience optimisation and related products. IoB also combines existing technologies that focus on the facial recognition, location tracking and Big Data. For example, Uber uses IoT data on drivers, passenger preferences to reinvent Customer Experience and of course IoB is used inevitably in fitness app to suggest appropriate exercise for the users by monitoring their diet,sleep patterns , heart rate or blood sugar levels.

Gayathri. R

IT – A , Third year

Winning WWDC Challenge

by Sabesh Bharathi , IT – B , Third Year

It's that time of the year again. June 2021 means Apple's Worldwide Developers Conference! There is a lot of hype for it within and outside the developer community. Every year, it comes around with futuristic software pre-releases and we get to witness the first look of the newer generation of Apple Operating systems, which includes: iOS, iPadOS, macOS, watchOS, and tvOS. This year, it's speculated to be so jam-packed that they released a few tidbits beforehand. They include features like Lossless music and Spatial audio or 'Hi-fi Audio' coming for Apple Music and more brilliant accessibility features coming to the Apple watch (assistive touch) and iPad (eye-tracking).

Swift Student Challenge

A couple of months before WWDC, Apple releases a WWDC Student Scholarship (till 2019) where 350 student winners around the world would be selected and be given a ticket to attend WWDC for free (which is otherwise around $1,599). And all the WWDC winners have fun, gathering at Apple Park, Cupertino, California while getting to witness the most exquisite software pre-releases in the world.

But since 2020, the game has changed. Due to Covid-19, WWDC is now held virtually for the last two summers. So it is now known as the Swift Student Challenge and the winners get exclusive WWDC outer-wear, some cool WWDC jacket pins, and a one-year membership to Apple's Developer Program. Nothing can match the offline visit to Apple park and community bonding of course. And it so happens, that I am one of Swift Student Challenge winners this time!

My submission for this year is a Swift Playground book called Ruby's Dilemma. It includes 60% markup and 40% actual code. It is a Swift playground where the user travels along The subsequent page takes a psychological toll on the users as I begin to reveal that whatever Ruby saw so far was an illusion. The page presents a SwiftUI view with question cards that question the Users as to what they think they saw so far, regarding the volcanoes and the lava. But the answers are surprisingly different. It is revealed that the volcanoes were actually factory emissions and the lava was toxic waste. Finally, it is also revealed that the monster was not a dragon, but a Human being. The playground ends with environmental facts and how we need to collectively stop pollution and practice eco-friendly solutions to prevent climate change and other disasters to humanity. with the mascot - Ruby the Rabbit. You get to explore the life of Ruby the Rabbit. It starts with a simple SwiftUI view that shows Ruby with a tappable micro-interaction. It

requests you to input a piece of code to let Ruby play her new music composition (which was handmade using Garageband by Apple) On the next page of the playground book, a monster tries to destroy Earth and Ruby's habitat. With yet another SwiftUI View, you are expected to tap on the right burrow to In the next view, there's a Labyrinth that you have to help Ruby navigate. It pops open your iPad's camera and you need to point at a flat surface and tap. This places the Labyrinth as an Augmented Reality Model. I used RealityKit and ARKit to achieve this. All assets for this were designed and programmed using Apple's Reality Composer. It was then imported as a .reality file and I used raycast to cast the Reality Model onto an AR surface. It also supports Scene Reconstruction on devices with a LiDAR scanner. You need to point Ruby to the exit in time, and any wrong decision will flood the labyrinth with the Dragon's Lava

The Verdict

I waited patiently since the submission date on 18th April 2021 for the results. I had fun building the playground and learned a lot about new exciting technologies, but I was not really sure it would make it. I always felt like there was room for improvement and I couldn't help but think of how I could have changed a million things about it to make it better. But it was done and dusted so I engaged in other activities until I got a call from Apple PR on 25th May.

The person from Apple wanted to talk to me about me and my WWDC submission and I told him all about myself. My background, my passion, my goals in the future, and of course, a brief overview of my submission. However, I was still unaware of the results. June 1 came in no time and I opened the results portal with my eyes closed shut. I did not open them for a solid minute before slowly opening them and squinting at the title on the webpage: Congratulations!

The next 24 hours were insanely fun, hyping about it to family and friends; connecting online with the community was just bliss and honestly a blur. I still don't remember how 2 days went by swift-ly after the results. My submission is open-sourced on Github and Youtube for the community to witness.

Unfortunately, I do not get to travel to Apple Park in Cupertino, San Jose but I am getting to connect with more and more winners online as WWDC nears.

Google Internship Pathway

I am Manoj Ravichandran, a pre-final year student of the B-Tech IT Department. I am an incoming SDE intern at Google. Google has always been one of my dream companies and this a huge step forward in my career, and this was possible only because of the amazing exposure and guidance provided by the department and college CDC. Until my 2nd Semester I was focussing only on my academics, I was working hard to get a good gpa. I was ecstatic to receive the merit scholarship but I found out a good cgpa can help you get shortlisted but just the cgpa won't get you selected for various internship programs.

So I started exploring web-development, I used platforms like Youtube, Udemy, Coursera to understand the fundamentals of Web-development. I was fortunate to get an opportunity to develop the IT department's "Hack&Tackle" website. I frequently interacted with my seniors which really helped me find my path. I took part in last year's Invente and secured first place in Websitica and WebITOut webdev competitions organized by the IT and CSE departments respectively. Soon afterwards, seniors suggested that I start focusing on Data- Structures and Algorithms , which is crucial to clear top tech companies interviews .

To improve my DSA skills, I started reading fundamental concepts on geeksforgeeks.com then tried solving problems on leetcode. I started using the "Cracking the Coding Interview" Book by Gayle Laakmann. The book features nearly 200 programming questions and solutions asked by Google, Amazon, Facebook, Microsoft and more. In addition, the author gives a detailed rundown of what to expect for each company's recruiting process, how to prepare, and what is unique about their interview. It's marketed to aspiring software engineers but also caters to experienced candidates, testers, product managers, tech leads, startups, interviewers, and more.

Google came to our college to offer internship opportunities, students were shortlisted based on their resume and an online coding round. Shortlisted students were invited for an interview preparation session. The goal of this session was to help the students navigate through Google's process. Google's Technical interview was a good learning experience. I had friendly interviewers who made the interview process very smooth for me. There were 2 sets of technical interviews 45 mins each which are eliminative in nature that focused on topics like strings, graphs, dfs-traversal. The questions were abstract and incomplete. So, it took me a few minutes to fully understand the questions. At first, I provided the interviewer a brute force approach and then optimized my solution.

I learnt a lot of key things during the whole process, and the most important ones being how important it is to talk out loud and to pay attention to every detail when the interviewer says something. Explain your thought process and decision making throughout the interview. In all technical interviews, inter-

viewers are evaluating not only your technical abilities but also how you approach problems and how you try to solve them. Finally I would like to thank my family, my seniors and my friends who inspired me and helped me achieve this feat.

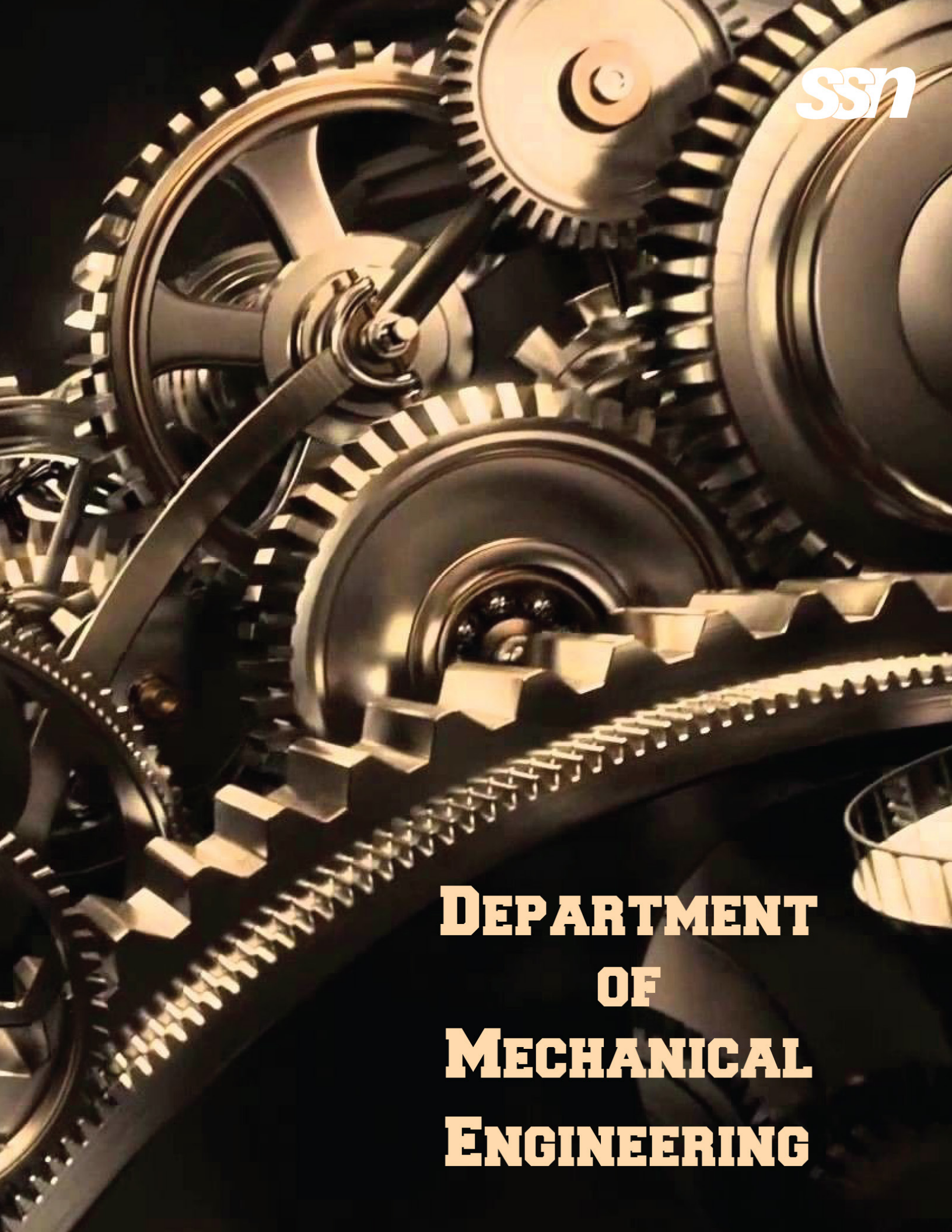
Here are some tips to prepare for the Technical Interviews:

Make sure you are familiarized with Computer Science fundamentals and revise data structure and algorithm fundamentals.

Write code that is easy to read and understand and ensure that it gives you the correct output. Handle corner cases correctly.

Understand and make sure that you substantiate what your CV/resume says – for instance, if you list C++ or JavaScript as your key programming language, questions about this are fair game and may be asked of you.

-Manoj Ravichandran IT – B, Third year



Department of Mechanical Engineering

From the HOD's Desk

Department of Mechanical Engineering

Student Innovation has come to the limelight amid these unprecedented times. These innovations have been in the form of simple, smart, sustainable solutions to many of the crucial problems we were faced with in the pandemic. INVENTE since its inception has always been a platform where student innovation is celebrated through interdepartmental collaboration and knowledge exchange. I am extremely pleased to welcome you all to be a part of the sixth edition of INVENTE. I'm proud that our students overcame various hurdles to successfully conduct the previous edition. This edition will be the 2nd year it is held online due to the restrictions of the pandemic but I'm sure it will set the bar even higher and turn out to be a wonderful experience for all the students, participants and faculty involved. I would like to appreciate the efforts taken by all the departments to organize INVENTE 6.0 and wish the best for its grand success.

Dr. S.R. Koteswara Rao

Head of the Department

Department of Mechanical Engineering

Technical Articles:

Flying Car – A Dream come true in India

From the time humans walked on earth we dreamt of the skies. We all would have had the same desire to fly at some point in our lives. From flying kites to paper planes, from planes to helicopters, our desires changed the world. But private aero mobility vehicles remained a dream for many people. We all have seen private flying vehicles like flying cars in movies like Harry potter and Back to the future. Many organizations and universities have tried their hand in this area. There have even been numerous competitions like the one conducted by GoFly aiming to create a personal flying vehicle. And now it is closer to home than we could have ever imagined.

A Chennai based startup Vinata Aero mobility is all set to unveil its hybrid flying car to the world next month on October 5, at one of the most popular aviation exhibitions – Helitech Expo held at the Excel, in London. The company's design shows a 1-ton-weighing, two-seater vehicle based on Vertical Take Off Landing (VTOL) system. The company website specifies a maximum payload of 250 kgs, at a top speed of 120kmph, with 60-minute flight time endurance. The vehicle is propelled by a coaxial quad-rotor system powered by eight BLDC motors and an equal number of fixed-pitch propellers. The proposed vehicle also has wheels to enable easy maneuverability. Distributed Electric Propulsion (DEP) is used in this vehicle so that if one or more motors or propellers fail, the other working motors and propellers can safely land the aircraft.

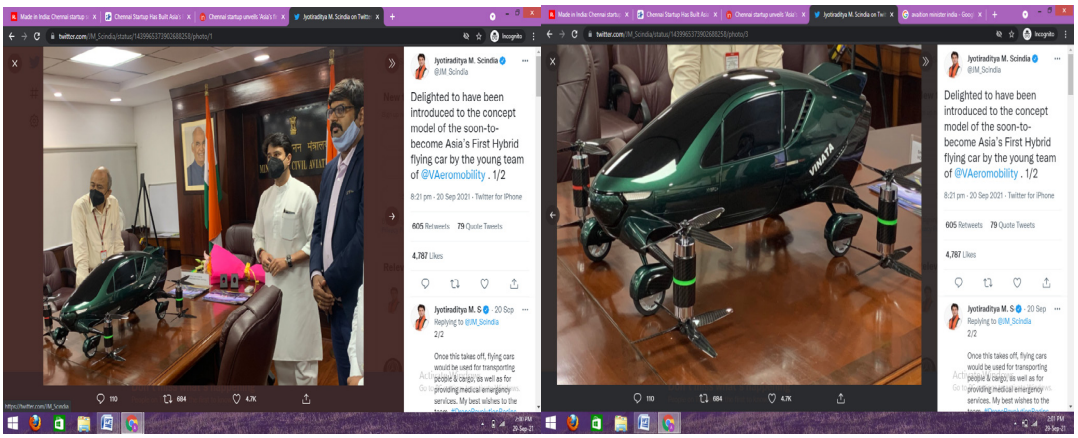
According to Yogesh Ramanathan, Founder and CEO of Vinata Aero mobility, the company is hoping to start flight trials of their Hybrid-electric Flying car by 2023 and make it available for Commercial flights by 2025.They are made of a 15-member team including ISRO's top space scientist Dr AE Muthunayagam serving as their principal advisor. Dawn Zoldi, a former US Air Force colonel with over 28 years of experience, is also on the team as a UAM (Urban Air Mobility) advisor.

The team have also met India's Minister for Civil Aviation, Shri Jyotiraditya Scindia to showcase their hybrid flying car concept model. The minister took to twitter saying "Once this takes off, flying cars would be used for transporting people &cargo, as well as for providing emergency medical services"

Aditya K

Dept. of Mechanical Engineering

4th year



The team meeting with the Civil Aviation Minister of India, Shri Jyotiraditya Scindia

https://www.indiatimes.com/technology/news/chennai-startup-hybrid-flying-car-india-549916.html

https://www.republicworld.com/india-news/city-news/made-in-india-chennai-startup-set-to-launch-asias-first-hybrid-electric-flying-car.html

https://www.helitech.co.uk/exhibitors/vinata-aeromobility-pvt-ltd/

Can Hydrogen be the answer to the Fuel Woes of the Airline Industry?

The aviation sector is on the brink of a crisis. Its future is in limbo as the world moves towards decarbonization. Planes are currently only responsible for 2 to 3% of the world's carbon dioxide emissions, but that's expected to rise to 25% by 2050.

Most major polluters have clear technology pathways to a cleaner future. However, the aviation industry has no clear way forward for replacing kerosene. It's projected that with the continued growth of passenger numbers and the expected decarbonization across other industries that it could represent as much as 25% of total worldwide emissions by 2050.

With ambitious environmental goals set forth by the various world Governments in accordance to the Paris Climate change agreement, the Airline Industry is under tremendous pressure, both politically and financially, to switch to more eco-friendly alternative fuel and reduce the greenhouse gases it produces. One of the leaders in the competition for alternative fuels for aircraft applications is Liquid Hydrogen.

Recently, Airbus revealed 3 concept aircraft in a project dubbed Zero-E, each of them to run in a Hybrid mode with Liquid Hydrogen being burnt via turbofan engines and electricity being generated by Hydrogen Fuel Cells. Now

the main question in everyone's mind is whether this concept is really viable or is it doomed to become another ambitious project, never to leave the confines of the drawing room.

Hydrogen has the advantage of its feedstock being just water. Due to this the raw materials needed for Hydrogen production do not require any preprocessing and are essentially limitless. This is the main drawback over deployment of biofuels in the airline Industry there is not enough feedstock to match the scale of production needed for powering the Airline Industry. Unlike Biofuels it does have a questionable Environmental Impact – clearing large tracts of rainforests to create more oil plantations.

Hydrogen also has the added advantage of having high energy density of about 40,000 Wh/Kg which is about 236 times the energy density of a high-end Lithium-Ion Battery whose energy density ranges around 250-280 Wh/Kg – the main obstacle of deploying lithium-ion Batteries on Aircraft.

It also has 3 times the gravimetric energy density of 120 MJ/Kg to that of Kerosene's just 44 MJ/Kg. Hydrogen also pushes the efficiency of the Gas turbines it runs leagues ahead of present generation engines deployed on modern day aircraft.

Hydrogen, despite being the most abundant element in the Universe is not readily available with most of it being locked up in water as H_2O and various other Hydrocarbons. The process to extract Hydrogen from these resources requires a tremendous amount of input energy and is not at all inefficient. Even with the most efficient extraction process of today: Polymer Exchange Membrane Electrolysis (PEM) which has a maximum efficiency of about 80%.

An additional Energy Loss is also created during the compression and cryogenic cooling to form Liquid Hydrogen. This significantly adds cost and complexity to both the aircraft and the production centre as Hydrogen is the second most difficult gas to liquefy after Helium.

Hydrogen also has a bad habit of attacking the container in which it is stored due to the small atomic size of its atoms thus causing hydrogen embrittlement and can compromise the structural integrity of the fuel tank in which it is housed. Hydrogen also needs specialized reinforced cryogenic tanks which can store them without leakages which can lead to additional weight on the aircraft.

Hydrogen also requires massive changes to both the airframe design and Airport infrastructure which can cost over a trillion Dollars. Though new radical designs like the Blended Wing Body design have come up and have been put forward by Airbus in their Zero-E project, they still need to be tested in the real-world environment before they can be adopted.

Though Hydrogen has excellent advantages and may be an end all solution to the woes of the Airline Industry, there are a multitude of challenges that it needs to overcome before it can be adopted by the Airline Industry.

Pratulya Ramprasad,

Dept. of Mechanical Engineering

4th year

Research Article

Metal Based Syntactic Composites

Syntactic composites or foams are materials developed using metal, ceramic or plastic matrix filled with hollow inclusions also called the micro balloons. The filler material (for the hollow inclusions) used for the composite is mainly classified into two types which include, hollow shells and porous particles. The hollow shell inclusion is mainly made of glass, ceramic, metal and fly ash whereas the porous particles include clay, pumice, perlite etc. Aluminum alloys groups are primarily used as the matrix material followed by the Magnesium alloys. Along with these elements, Zinc, Iron, Copper and Titanium are also used as matrix materials.

The presence of hollow inclusions in these composites posits certain facilities like lower density, low coefficient of thermal expansion, and increased specific strength. Another major advantage of utilizing these materials is the degree of flexibility they offer which enables customization for almost any application. There is a wide variety of choices for the selection of matrix material, along with the micro balloon's composition and size. Syntactic foams also provide higher energy dissipation and better thermal insulation owing to their porous nature.

Metal Matrix based Syntactic Foams (MMSF) are already used in a number of applications for safety and energy absorption. Owing to their light weight, high energy absorption capacity, capability to exhibit large compressive strain and high specific strength, syntactic foams find their applications in vehicles and armors. Despite having ubiquitous structural applications, the initial focus behind the early development of MMFS's was their ability to serve as some kind of "self-lubricating" material, thanks to the opened hollow spheres on the surface, which act as lubricant reservoirs to maintain wet lubricated condition for a longer time.

Syntactic foams also find their place in applications as alternatives to a number of standard materials, such as metals, plastics, and different foams. These alternatives don't provide an equivalent degree of density, strength, and weight savings as syntactic foams. Other applications of syntactic foams are in the marine industry due to their low moisture absorption capability and buoyancy. These materials can additionally be employed for deep water pipe insulation, spacecraft, boat hulls, underwater vehicles.

Surya Prakash S

Dept. of Mechanical Engineering

4th year

INTERNSHIP REPORT

1ST FEB - 15TH FEB 2021

ASHOK LEYLAND

INTRODUCTION

Ashok Leyland is a reputed company that has embarked its footprint in various fields. The major business is extracted from the automobile industry, but they are also involved in other fields like Power Solutions and Finance. The automotive sector of the company is classified into Commercial Vehicles and Defense Vehicles. The internship was provided in the Defense Sector located at Ennore.

The Defence Sector of the company mainly produces 3 kinds of vehicles. They are Stallions, Super Stallions and Armoured Vehicles (AVs).

The different departments present in this sector are Marketing, Product Design and Development (PD), Aggregate/ Cluster team, Vehicle Integration, Internal Testing. Marketing team gets the needs of the customer in the form of RFP (Request for Proposal). This contains almost the complete specifications of the vehicle. These specs are then sent to the PD team, who start designing and developing the product. Aggregate Team is responsible for the different parts/ aggregates that are present. There are multiple teams responsible for different aggregates like Engine block, Gearbox, etc.

After the complete manufacture of the vehicle, there are a series of tests carried out for validation. They are namely User and Technical Trials. Before these trials, the company carries out certain tests called Internal Tests, which are performed on their own inside their premises, which are managed by the Internal Testing team. These trials are one of the preliminary tests that are performed on the vehicle that include various tests like steering, braking, torture track tests, etc. Internal Trials generally last for a couple of weeks to perform and after this the vehicle leaves the premises and goes to a third party. The second testing is the User Trials. The vehicle is given to a user (not necessarily the customer) for checking the performance and comfort. These tests are usually carried out in different terrains namely deserts, plains and hilly terrains. Then, there are Technical Trials conducted which contain the results of the various criteria that are required by the customer and whether or not they are satisfied.

INTERNSHIP EXPERIENCE

My role at the company was to observe each department and provide assistance whenever required. Most of the time was spent at the Ennore plant, but I was also provided the opportunity to go to the test tracks at Veliyovalchavadi and WABCO India. WABCO had only brake trials, whereas, in Veliyovalchavadi (VVC) the tests conducted were for different aggregates like Engine, Brakes, Tyres, etc.

At Ennore, I had the opportunity to perform some field work in the design field using CATIA (V5 version). I also had a chance to look at the various vehicle assembly plants, namely, Defence vehicles and Commercial Vehicles. The internship also offered an opportunity to interact with almost all departments mentioned above and learn their specific roles more in-depth.

Then, I visited the test tracks at VVC where I was briefed on the various tests that are carried out internally. I also saw the 6 poster and 10 poster testing. These tests are nothing but exposing the vehicles to 1000s of cycles of vibrations in all orientations in order to speed up the internal testing process. These conditions can be modified and set as desired by the user according to the vehicle application conditions (i.e.) the terrain and climatic conditions of operation. These tests generally half the testing time, so that it gives more time to carry out modifications if required.

I also had the opportunity to visit WABCO India, Sriperumbudur. This campus is specifically for brake testing. Here, I was first given a vivid description about the braking circuit, with the help of circuit diagrams and then physically in the vehicle itself. Then, I also visited the test tracks where the tests are carried out based on IS11852. There are mainly 3 types of tests carried out, Part 3 (Dynamic Testing), Part 4 (Static Testing) and Part 9 (Anti-Lock Braking System (ABS) Testing). While Part 3 and 4 are performed for all vehicles, Part 9 is restricted to vehicles that have the ABS feature.

LEARNING AND ACKNOWLEDGEMENT

This internship gave me a brief idea about the design and development process that is involved in the production of a vehicle and the various departments that are involved in the same. The visit to all the departments helped me to understand their role in the whole process more in-depth. I also had the opportunity to be involved in design processes using CATIA and learning the V5 version, having already learnt the V4 version in Semester V.

The visits to VVC and WABCO gave me technical knowledge about the vehicle and its components like brakes. At Ennore, I got an idea about how the vehicle is assembled part by part, right from the Engine Gearbox Assembly to the Cabin building.

Thus, to summarize, this internship gave me a glimpse of how difficult it is to manufacture and release a vehicle in a competitive market. It also enabled me to think like an automobile engineer when I had the opportunity to perform fieldwork. Overall, it was a fun, engaging and educating experience.

I also had the chance to interact with highly intelligent engineers who aided me in understanding the concepts. They acted as teachers and professors rather than tech professionals. Even when I visited other premises, there was some qualified professional who was accompanying me.

I would like to take this opportunity to thank all the people who supported me during my tenure at the internship and also helped me understand certain concepts (like braking circuit) that were tricky to grasp in the first attempt.

S Anush Lakshman

Dept. of Mechanical Engineering

4th year

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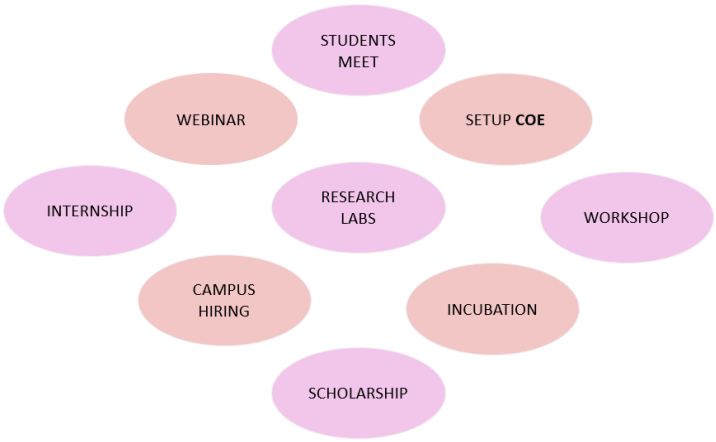

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ISACA
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DigIT
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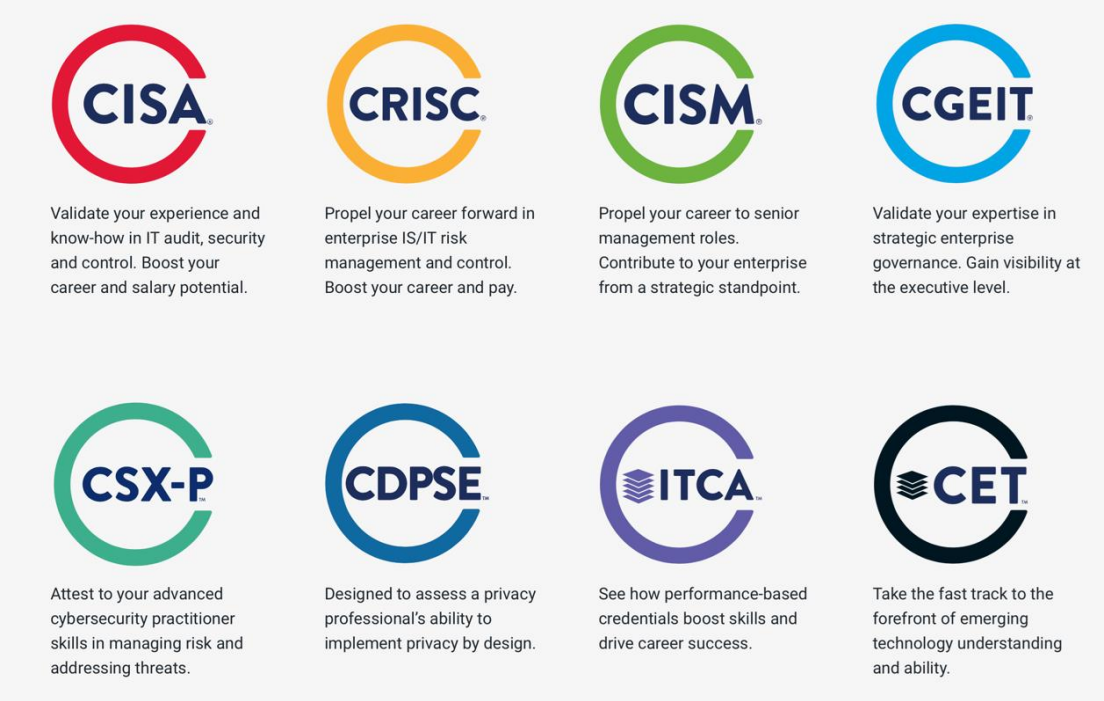

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